Installation, Start-Up and Service Instructions

SAFETY CONSIDERATIONS

Installing, starting up, and servicing this equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start up, and service this equipment.

Untrained personnel can perform basic maintenance functions, such as cleaning coils. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature and on tags, stickers, and labels attached to the equipment.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging, and setting bulky equipment.

ELECTRIC SHOCK HAZARD.

Open all remote disconnects before servicing this equipment.

IMPORTANT: This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with these instructions may cause radio interference. This equipment has been tested and found to comply with the limits of a Class A computing device as defined by FCC (Federal Communications Commission, U.S.A.) regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

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Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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INTRODUCTION

These instructions cover installation, start-up and service of 30GT040-070 Flotronic™ liquid chillers with electronic controls and units with factory-installed options (FIOPs).

Standard chillers are equipped with electronic expansion valves (EXVs) and FIOP units have conventional thermostatic expansion valves (TXVs) and liquid line solenoid valves (LLSVs). Differences in quick test procedures and operation sequence should be carefully noted when following these instructions.

Inspect the unit upon arrival for damage. If damage is found, file a claim right away with the shipping company. When considering location for the unit, be sure to consult National Electrical Code (NEC, U.S.A.) and local code requirements. Allow sufficient space for airflow, wiring, piping, and service. See Fig. 1 and 2. Be sure surface beneath the unit is level, and is capable of supporting the operating weight of the unit. See Fig. 3 and Tables 1 and 2.

INSTALLATION

Step 1— Rig and Place the Unit — These units are designed for overhead rigging. Lifting holes are provided in frame base channels (see rigging label on unit). Use spreader bars or frame to keep cables or chains clear of unit sides. Run cables to a central suspension point so that angle from horizontal is not less than 45 degrees. Raise and set down unit carefully. Export units and domestic units with skids are rigged and placed as described below.

DOMESTIC UNITS — Standard units are shipped without skids. If overhead rigging is not possible, place chiller on skid or pad for rolling or dragging. When rolling, use minimum of 3 rollers. When dragging, pull the pad. *Do not apply force to the unit.* When in final position, raise from above to lift unit off the pad.

EXPORT UNITS AND DOMESTIC UNITS WITH SKIDS — All units are mounted on skids with vertical coil protection. At the job site, leave unit on the skid until unit is in final position. *While on the skid, the unit can be rolled or skidded on the floor, with force applied to the skid, not the unit.* When the skid is removed, the unit must be handled by overhead rigging as described previously. If it is necessary to remove the skid before the unit is in final position and unit can be dragged, place unit on a large pad and drag by the pad. *Do not apply force to the unit.* When in final position, raise from above to lift unit off the pad.

PLACING UNIT — Refer to Fig. 1 and 2 for airflow clearances. Provide ample room for servicing and removing cooler, depending on unit location. Refer to cooler dimensions in Fig. 1 and 2. For multiple units, allow 8 ft (2440 mm) separation between units for airflow and service. Placement area must be level and strong enough to support operating weight of unit (see Fig. 3 and Tables 1 and 2). Weights at unit support points are shown in Fig. 3. Bolt unit securely to pad when unit is positioned and leveled. Fasteners for mounting unit are field supplied. Check that unit is mounted levelly to ensure proper oil return to compressors. If vibration isolators (field supplied) are required for a particular installation, refer to unit weight distribution in Fig. 3 to aid in proper selection of isolators.

Step 2 — Check Compressor Mounting — All compressors on 30GT040-070 units are mounted on pans and are held down by 4 bolts during shipment. After unit is installed, loosen each of these bolts until the flat washer can be moved with finger pressure. See Fig. 4 and 5.

Step 3 — Cooler Fluid and Drain Piping Connections — When facing cooler side of unit, inlet (return) fluid connection is on the right, nearest the control box. Outlet (supply) fluid connection is on the left. The cooler has fluid-side victaulic-type connections (follow connection directions as provided by the coupling manufacturer). If accessory grilles have been added, holes must be cut in grilles for field piping and insulation.

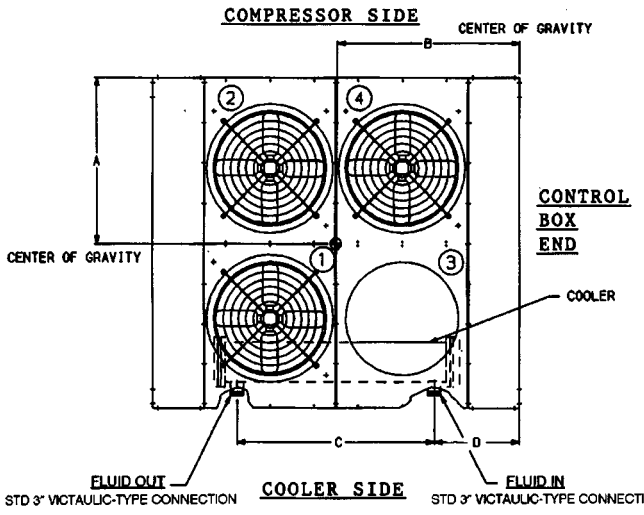
Although cooler has an air vent, it is recommended that field-supplied air vents be installed at the highest point in the system to facilitate servicing. Field-supplied shut-off valves should also be installed to facilitate servicing and flow balancing. Locate valves in return and supply cooler fluid lines as close to the chiller as possible.

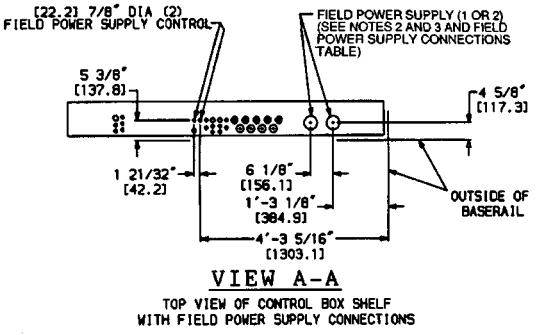
Upon completion of the field piping installation, in areas where the piping is exposed to 32 F (0° C) or lower ambient temperatures, freeze-up protection is recommended using inhibited ethylene glycol (or other suitable corrosion-inhibitive antifreeze) and electric heater tapes. Heater tapes should have a rating for area ambient temperatures, and should be covered with a suitable thickness of closed-cell insulation. Route power for the heater tapes from a separate fused disconnect. Mount the disconnect within sight from the unit as prescribed by local or NEC codes. Identify disconnect as heater tape power source, with warning that power must not be turned off except when servicing the unit.

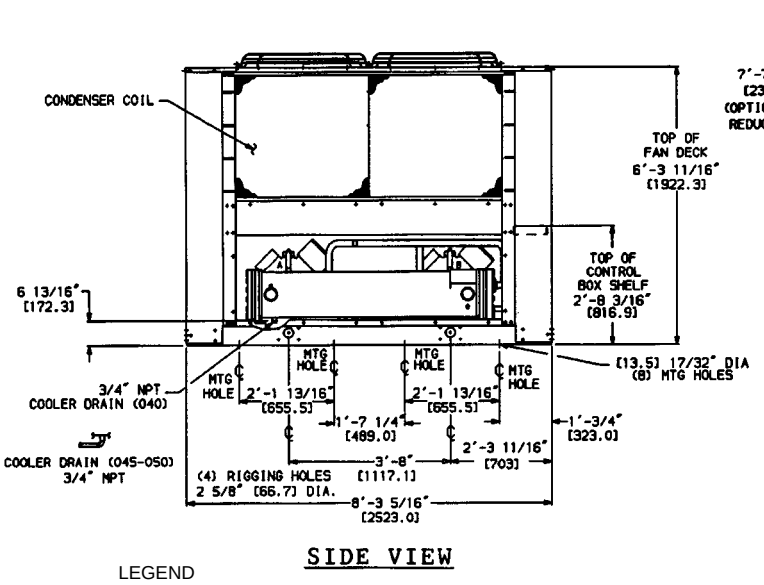
IMPORTANT: Before starting unit, be sure all of the air has been purged from the system.

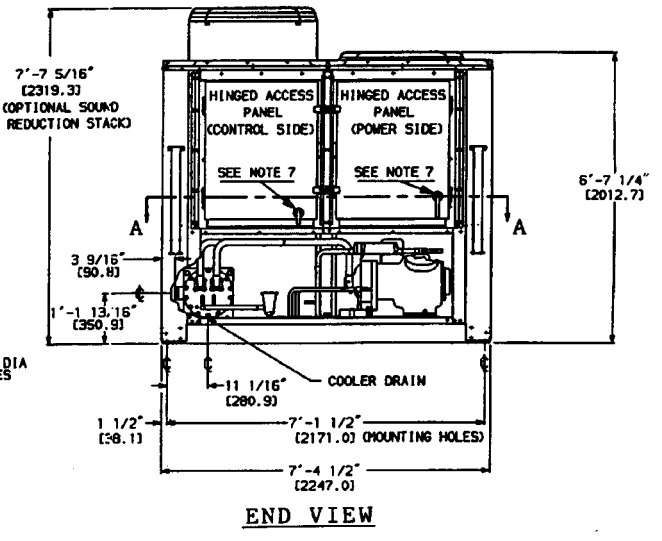
A drain connection is located at leaving fluid (supply) end of cooler. See Fig. 1 and 2.

PREPARATION FOR YEAR-ROUND OPERATION — If unit is to operate all year round, add sufficient inhibited ethylene glycol (or other suitable corrosion-inhibitive antifreeze) to the cooler water to prevent freeze-up under cold operating conditions. Consult local water authority on characteristics of area water and a recommended inhibitor for the cooler fluid loop.




[22.2] 7/8" DIA (2) FIELD POWER SUPPLY CONTROL
FIELD POWER SUPPLY (1 OR 2) (SEE NOTES 2 AND 3 AND FIELD POWER SUPPLY CONNECTIONS TABLE)
5 3/8" [137.8]
4 5/8" [117.3]
1 21/32" [42.2]
6 1/8" [156.1]
1'-3 1/8" [384.9]
4'-3 5/16" [1303.1]
OUTSIDE OF BASERAIL
VIEW A-A
TOP VIEW OF CONTROL BOX SHELF WITH FIELD POWER SUPPLY CONNECTIONS





LEGEND

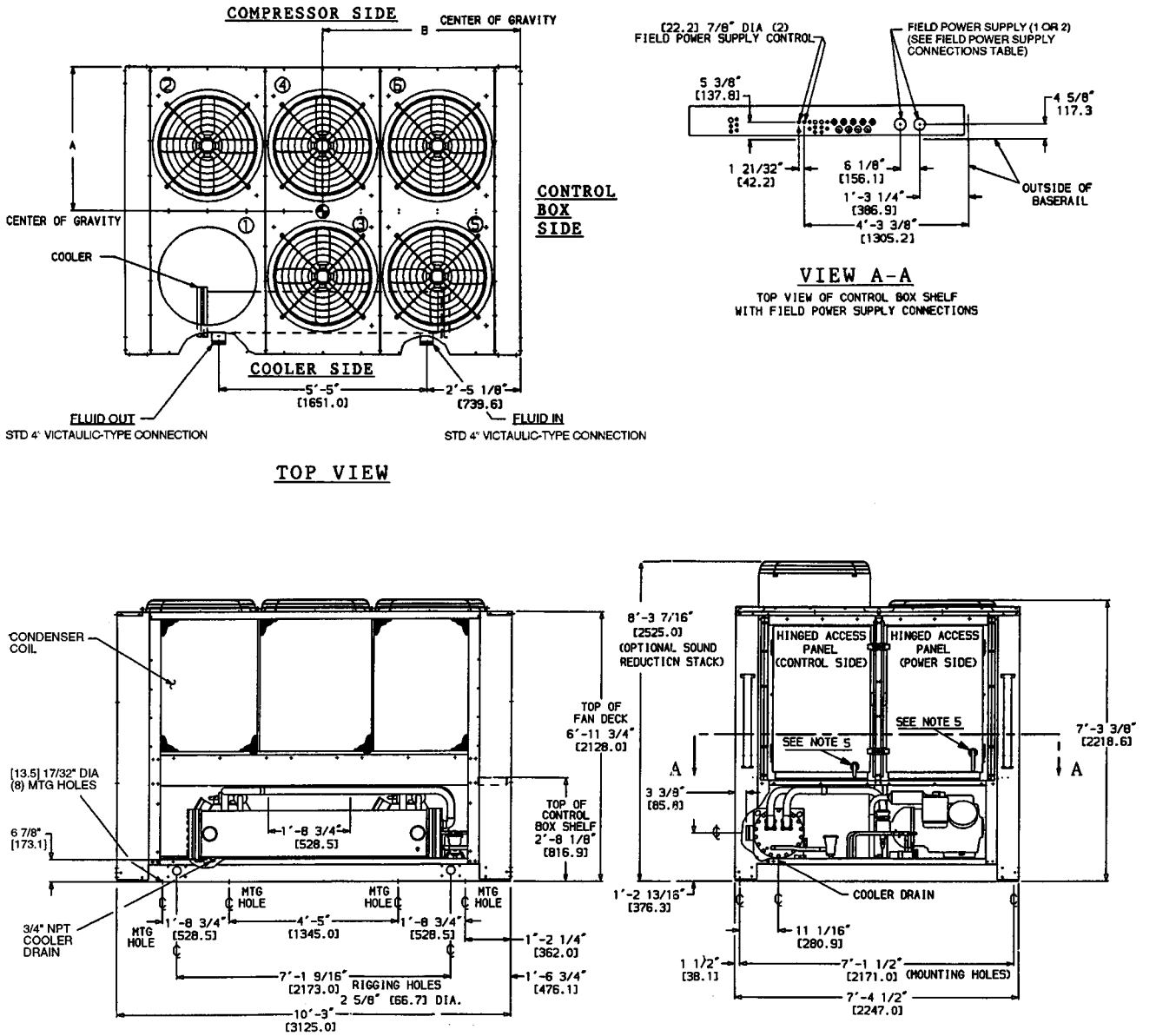
C — Copper Fins, Copper Tubing
Mtg — Mounting

NOTES:
1. Unit must have clearances for airflow as follows:
   TOP — Do not restrict in any way.
   ENDS — [1524] 5 ft
   SIDES — [1829] 6 ft
2. 2.00″ dia holes are recommended for parallel conductors on 040 and 045 (208/230 V) units.
3. 3⅝″ dia hole is recommended for single entry power on 050 (208/230 V) units.
4. Mounting holes may be used to mount unit to concrete pad. They are not recommended for spring isolator location.
5. If spring isolators are used, a perimeter support channel between the unit and the isolators is recommended.
6. Dimensions in [ ] are millimeters.
7. Thru-the-door handles for non-fused disconnect option on 380/415 v and 460 v units only. When unit has non-fused disconnect option, power-side door opens from right side, NOT left side as shown for standard units.

UNIT 30GT	DIMENSIONS			
	"A"	"B"	"C"	"D"
040	3′-5 11/16″ [1059]	3′-10 13/16″ [1189]	4′-5½″ [1359]	1′-11⅛″ [587.5]
040C	3′-5⅞″ [1064]	3′-11″ [1194]	4′-5½″ [1359]	1′-11⅛″ [587.5]
045	3′-6 1/16″ [1069]	3′-10 13/16″ [1189]	5′-5½″ [1663]	1′-5 3/16″ [436.6]
045C	3′-6 3/16″ [1072]	3′-11″ [1194]	5′-5½″ [1663]	1′-5 3/16″ [436.6]
050	3′-5⅞″ [1064]	3′-11″ [1194]	5′-5½″ [1663]	1′-5 3/16″ [436.6]
050C	3′-6″ [1067]	3′-11 3/16″ [1199]	5′-5½″ [1663]	1′-5 3/16″ [436.6]

FIELD POWER SUPPLY CONNECTIONS				
Unit 30GT	Voltage	Hz	Diameter	Qty
040,045	208/230	60	3⅝″ [92.0]	1
050	208/230	60	2½″ [63.5]	2
040-050	460	60	2½″ [63.5]	1
040-050	575	60	2½″ [63.5]	1
040-050	380	60	2½″ [63.5]	1
040,045	346	50	2½″ [63.5]	1
050	346	50	3⅝″ [92.0]	1
040,045	380/415	50	2½″ [63.5]	1
050	380/415	50	3⅝″ [92.0]	1

Fig. 1 — Dimensions, 30GT040-050



LEGEND

C — Copper Fins, Copper Tubing
Mtg — Mounting

NOTES:
1. Dimensions in [ ] are millimeters.
2. Unit must have clearances for airflow as follows:
   TOP — Do not restrict in any way.
   ENDS — [1524] 5 ft
   SIDES — [1829] 6 ft
3. Mounting holes may be used to mount unit to concrete pad. They are not recommended for spring isolator location.
4. If spring isolators are used, a perimeter support channel between the unit and the isolators is recommended.
5. Thru-the-door handles for non-fused disconnect option on 380/415 v and 460 v units only. When unit has non-fused disconnect option, power-side door opens from right side, NOT left side as shown for standard units.

UNIT 30GT	DIMENSIONS	
	"A"	"B"
060	3′-6⅞″ [1090]	4′-10⁵⁄₁₆″ [1481]
060C	3′-7″ [1092]	4′-10⁹⁄₁₆″ [1488]
070	3′-6″ [1067]	4′-10½″ [1486]
070C	3′-6³⁄₁₆″ [1072]	4′-10⅞″ [1496]

FIELD POWER SUPPLY CONNECTIONS				
Unit 30GT	**Voltage**	**Hz**	**Diameter**	**Qty**
060	208/230	60	2½″ [63.5]	2
070	208/230	60	3⅝″ [92.0]	2
060	460	60	2½″ [63.5]	1
070	460	60	3⅝″ [92.0]	1
060,070	575	60	2½″ [63.5]	1
060,070	380	60	3⅝″ [92.0]	1
060,070	346	50	3⅝″ [92.0]	1
060,070	380/415	50	3⅝″ [92.0]	1

Fig. 2 − Dimensions, 30GT060,070

MOUNTING WEIGHTS*

60 Hz UNITS

30GT UNIT SIZE	CONDENSER COIL†	LB				KG			
		A	B	C	D	A	B	C	D
040	C-AL	972	876	807	895	441	397	366	406
	C-C	1044	948	879	968	473	430	399	439
045	C-AL	999	895	845	943	453	406	383	428
	C-C	1071	967	917	1015	486	438	416	460
050	C-AL	1047	948	884	976	475	430	401	443
	C-C	1155	1057	992	1085	524	479	450	492
060	C-AL	1258	1130	1130	1113	570	512	505	562
	C-C	1362	1234	1217	1344	618	560	552	609
070	C-AL	1332	1212	1184	1301	604	550	537	590
	C-C	1489	1369	1340	1458	675	621	608	661

50 Hz UNITS

30GT UNIT SIZE	CONDENSER COIL†	LB				KG			
		A	B	C	D	A	B	C	D
040	C-AL	992	886	808	904	450	402	366	410
	C-C	1064	959	880	976	482	435	399	443
045	C-AL	1065	934	812	925	483	424	368	420
	C-C	1137	1007	883	998	515	457	401	452
050	C-AL	1074	968	889	986	487	439	403	447
	C-C	1182	1076	997	1095	536	488	452	496
060	C-AL	1269	1151	1123	1238	575	522	509	561
	C-C	1373	1255	1227	1342	623	569	556	609
070	C-AL	1508	1369	1226	1350	684	621	556	612
	C-C	1664	1526	1383	1508	755	692	627	684

LEGEND

C-AL — Copper Tubing, Aluminum Fins
C-C — Copper Tubing, Copper Fins

*Points A, B, C, and D are located in the corners of the unit. See Fig. 1 and 2 for dimensions.
†Contact your local Carrier representative for more information on Epoxy-coated and pre-coated aluminum fins.

NOTE: If spring isolators are used, a perimeter support channel between the unit and the isolators is recommended.

RIGGING CENTER OF GRAVITY

30GT UNIT SIZE	040		045		050		060		070	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
X Dimension	46 13/16	1189	46 13/16	1189	47	1194	58 5/16	1481	58 1/2	1486
Y Dimension	41 11/16	1059	42 1/16	1069	41 7/8	1064	42 7/8	1090	42	1067

Fig. 3 — Mounting Weights (Approximate)

Table 1 — Physical Data — 60 Hz

ENGLISH

30GT UNIT SIZE			040	045	050	060	070
APPROX OPERATING WEIGHT — lb		C-AL	3550	3681	3856	4740	5028
		C-C	3838	3969	4289	5157	5656
REFRIGERANT CHARGE — lb							
R-22	Ckt A	Total/Over Clear Glass	39/12	40/12	48/12	52/14	70/15
	Ckt B		48/12	46/12	60/12	54/14	69/15
COMPRESSORS, Type...rpm			Reciprocating, Semi-Hermetic...1750				
06E*	(No.) Ckt A		(1) 2250	(1) 2250	(1) 6265	(1) 6275	(1) 6299
	(No.) Ckt B		(1) A250	(1) F265	(1) F275	(1) F299	(1) F299
Oil Charge — Compressor/pt			250/14, 265/19, 275/19, 299/19				
Capacity Control Steps			4	4	4	4	4
% Cap.	Ckt A		50.0	42.4	47.6	43.3	50.0
	Ckt B		50.0	57.6	52.4	56.7	50.0
Minimum Step Capacity (%)			25.0	21.2	31.7	28.8	33.3
CONDENSER FANS — Type			Propeller, Direct Drive				
Standard							
Fan Speed — rpm			1140	1140	1140	1140	1140
No. Blades...Diameter — in.			4...30	4...30	4...30	4...30	4...30
No. Fans...Total kW			4...6.2	4...6.2	4...6.2	6...9.3	6...9.3
Total Airflow — cfm			35,000	35,000	34,000	52,000	51,000
High Static							
Fan Speed — rpm			1750	1750	1750	1750	1750
No. Blades...Diameter — in.			12...30	12...30	12...30	12...30	12...30
No. Fans...Total kW			4...14.8	4...14.8	4...14.8	6...22.2	6...22.2
Total Airflow — cfm†			40,000	40,000	40,000	60,000	60,000
CONDENSER COILS — Type			Vertical and Horizontal, Plate Fin, Enhanced Tubing				
Tubes (Copper), OD — in.			0.375	0.375	0.375	0.375	0.375
Fins/in.			17	17	17	17	17
No. Rows — Ckt A or B			2	2	3	2	3
Face Area sq ft — Ckt A and B Total			80.5	80.5	80.5	116.7	116.7
Max Working Pressure Refrigerant — psig			450				
COOLER — No. ...Type			One...Direct Expansion, Shell and Tube				
No. Refrigerant Circuits			2	2	2	2	2
Net Fluid Volume — Gal. (includes nozzles)			10.9	13.5	13.5	18.0	18.0
Max Working Pressure							
Refrigerant Side/Fluid Side — psig							
Standard Cooler			278/300				
Australian Code Cooler			207/150				
FLUID CONNECTIONS — in.			Cooler Inlet and Outlet; Victaulic Type				
Inlet and Outlet			3	3	3	4	4
Drain			¾ NPT				

SI

30GT UNIT SIZE			040	045	050	060	070
APPROX OPERATING WEIGHT — kg		C-AL	1610	1669	1749	2150	2280
		C-C	1741	1800	1945	2339	2565
REFRIGERANT CHARGE — kg							
R-22	Ckt A	Total/Over Clear Glass	17.7/5.4	18.1/5.4	21.8/5.4	23.6/6.3	31.7/6.8
	Ckt B		21.8/5.4	20.9/5.4	27.2/5.4	24.5/6.3	31.3/6.8
COMPRESSORS, Type...r/s			Reciprocating, Semi-Hermetic...29.2				
06E*	(No.) Ckt A		(1) 2250	(1) 2250	(1) 6265	(1) 6275	(1) 6299
	(No.) Ckt B		(1) A250	(1) F265	(1) F275	(1) F299	(1) F299
Oil Charge — Compressor/L			250/6.6, 265/9.0, 275/9.0, 299/9.0				
Capacity Control Steps			4	4	4	4	4
% Cap.	Ckt A		50.0	42.4	47.6	43.3	50.0
	Ckt B		50.0	57.6	52.4	56.7	50.0
Minimum Step Capacity (%)			25.0	21.2	31.7	28.8	33.3
CONDENSER FANS — Type			Propeller, Direct Drive				
Standard							
Fan Speed — r/s			19	19	19	19	19
No. Blades...Diameter — mm			4...762	4...762	4...762	4...762	4...762
No. Fans...Total kW			4...6.2	4...6.2	4...6.2	6...9.3	6...9.3
Total Airflow — L/s			16 517	16 517	16 045	24 540	24 068
High Static							
Fan Speed — r/s			29	29	29	29	29
No. Blades...Diameter — mm			12...762	12...762	12...762	12...762	12...762
No. Fans...Total kW			4...14.8	4...14.8	4...14.8	6...22.2	6...22.2
Total Airflow — L/s†			18 876	18 876	18 876	28 314	28 314
CONDENSER COILS — Type			Vertical and Horizontal, Plate Fin, Enhanced Tubing				
Tubes (Copper), OD — mm			9.53	9.53	9.53	9.53	9.53
Fins/m			669	669	669	669	669
No. Rows — Ckt A or B			2	2	3	2	3
Face Area m^2 — Ckt A and B Total			7.48	7.48	7.48	10.84	10.84
Max Working Pressure Refrigerant — kPa			3103				
COOLER — No. ...Type			One...Direct Expansion, Shell and Tube				
No. Refrigerant Circuits			2	2	2	2	2
Net Fluid Volume — L (includes nozzles)			41.3	51.2	51.2	68.3	68.3
Max Working Pressure							
Refrigerant Side/Fluid Side — kPa							
Standard Cooler			1916/2068				
Australian Code Cooler			1430/1034				
FLUID CONNECTIONS — in.			Cooler Inlet and Outlet; Victaulic Type				
Inlet and Outlet			3	3	3	4	4
Drain			¾ NPT				

LEGEND

C-AL — Copper Tubing — Aluminum Fins Condenser Coil
C-C — Copper Tubing — Copper Fins Condenser Coil
OD — Outside Diameter

*06E250 compressors have 4 cylinders; all others have 6.
†Based on rated external static pressure of 0.4 or 1.0 in. wg (100 Pa or 250 Pa) as appropriate.

NOTE: Facing the compressors, Circuit A is on the right and Circuit B is on the left.

Table 2 — Physical Data — 50 Hz

ENGLISH

30GT UNIT SIZE			040	045	050	060	070
APPROX OPERATING WEIGHT — lb		C-AL	3550	3736	3916	4780	5453
		C-C	3878	4024	4349	5197	6081
REFRIGERANT CHARGE — lb							
R-22	Ckt A	Total/Over Clear Glass	39/12	40/12	48/12	52/14	71/15
	Ckt B		48/12	46/12	60/12	54/14	69/15
COMPRESSORS, Type...rpm			Reciprocating, Semi-Hermetic...1450				
06E*	(No.) Ckt A		(1) 2250	(1) 6265	(1) 6275	(1) 6299	(1) 6265, (1) F265
	(No.) Ckt B		(1) F265	(1) F275	(1) F299	(1) F299	(1) F299
Oil Charge — Compressor/pt			250/14, 265/19, 275/19, 299/19				
Capacity Control Steps			4	4	4	4	6
% Cap.	Ckt A		42.4	47.6	43.3	50.0	58.0
	Ckt B		57.6	52.4	56.7	50.0	42.0
Minimum Step Capacity (%)			21.2	31.7	28.8	33.3	19.3
CONDENSER FANS — Type			Propeller, Direct Drive				
Standard							
Fan Speed — rpm			950	950	950	950	950
No. Blades...Diameter — in.			6...30	6...30	6...30	6...30	6...30
No. Fans...Total kW			4...6.2	4...6.2	4...6.2	6...9.3	6...9.3
Total Airflow — cfm			35,000	35,000	34,000	52,000	51,000
High Static							
Fan Speed — rpm			1445	1445	1445	1445	1445
No. Blades...Diameter — in.			12...30	12...30	12...30	12...30	12...30
No. Fans...Total kW			4...14.8	4...14.8	4...14.8	6...22.2	6...22.2
Total Airflow — cfm†			40,000	40,000	40,000	60,000	60,000
CONDENSER COILS — Type			Vertical and Horizontal, Plate Fin, Enhanced Tubing				
Tubes (Copper), OD — in.			0.375	0.375	0.375	0.375	0.375
Fins/in.			17	17	17	17	17
No. Rows — Ckt A or B			2	2	3	2	3
Face Area sq ft — Ckt A and B Total			80.5	80.5	80.5	116.7	116.7
Max Working Pressure Refrigerant — psig			450				
COOLER — No. ...Type			One...Direct Expansion, Shell and Tube				
No. Refrigerant Circuits			2	2	2	2	2
Net Fluid Volume — Gal. (includes nozzles)			10.9	13.5	13.5	18.0	18.0
Max Working Pressure							
Refrigerant Side/Fluid Side — psig							
Standard Cooler			278/300				
Australian Code Cooler			207/150				
FLUID CONNECTIONS — in.			Cooler Inlet and Outlet; Victaulic Type				
Inlet and Outlet			3	3	3	4	4
Drain			¾ NPT				

SI

30GT UNIT SIZE			040	045	050	060	070
APPROX OPERATING WEIGHT — kg		C-AL	1628	1694	1776	2168	2473
		C-C	1759	1825	1972	2357	2758
REFRIGERANT CHARGE — kg							
R-22	Ckt A	Total/Over Clear Glass	17.7/5.4	18.1/5.4	21.8/5.4	23.6/6.3	32.2/16.8
	Ckt B		21.8/5.4	20.9/5.4	27.2/5.4	24.5/6.3	31.3/16.8
COMPRESSORS, Type...r/s			Reciprocating, Semi-Hermetic...24.2				
06E*	(No.) Ckt A		(1) 2250	(1) 6265	(1) 6275	(1) 6299	(1) 6265, F265
	(No.) Ckt B		(1) F265	(1) F275	(1) F299	(1) F299	(1) F299
Oil Charge — Compressor/L			250/6.6, 265/9.0, 275/9.0, 299/9.0				
Capacity Control Steps			4	4	4	4	6
% Cap.	Ckt A		42.4	47.6	43.3	50.0	58.0
	Ckt B		57.6	52.4	56.7	50.0	42.0
Minimum Step Capacity (%)			21.2	31.7	28.8	33.3	19.3
CONDENSER FANS — Type			Propeller, Direct Drive				
Standard							
Fan Speed — r/s			15.8	15.8	15.8	15.8	15.8
No. Blades...Diameter — mm			6...762	6...762	6...762	6...762	6...762
No. Fans...Total kW			4...6.2	4...6.2	4...6.2	6...9.3	6...9.3
Total Airflow — L/s			16 517	16 517	16 045	24 540	24 068
High Static							
Fan Speed — r/s			24	24	24	24	24
No. Blades...Diameter — mm			12...762	12...762	12...762	12...762	12...762
No. Fans...Total kW			4...14.8	4...14.8	4...14.8	6...22.2	6...22.2
Total Airflow — L/s†			18 876	18 876	18 876	28 314	28 314
CONDENSER COILS — Type			Vertical and Horizontal, Plate Fin, Enhanced Tubing				
Tubes (Copper), OD — mm			9.53	9.53	9.53	9.53	9.53
Fins/m			669	669	669	669	669
No. Rows — Ckt A or B			2	2	3	2	3
Face Area m^2 — Ckt A and B Total			7.48	7.48	7.48	10.84	10.84
Max Working Pressure Refrigerant — kPa			3103				
COOLER — No. ...Type			One...Direct Expansion, Shell and Tube				
No. Refrigerant Circuits			2	2	2	2	2
Net Fluid Volume — L (includes nozzles)			41.3	51.2	51.2	68.3	68.3
Max Working Pressure							
Refrigerant Side/Fluid Side — kPa							
Standard Cooler			1916/2068				
Australian Code Cooler			1430/1034				
FLUID CONNECTIONS — in.			Cooler Inlet and Outlet; Victaulic Type				
Inlet and Outlet			3	3	3	4	4
Drain			¾ NPT				

LEGEND

C-AL — Copper Tubing — Aluminum Fins Condenser Coil
C-C — Copper Tubing — Copper Fins Condenser Coil
OD — Outside Diameter

*06E250 compressors have 4 cylinders; all others have 6.
†Based on rated external static pressure of 0.4 or 1.0 in. wg (100 Pa or 250 Pa) as appropriate.

NOTE: Facing the compressors, Circuit A is on the right and Circuit B is on the left.

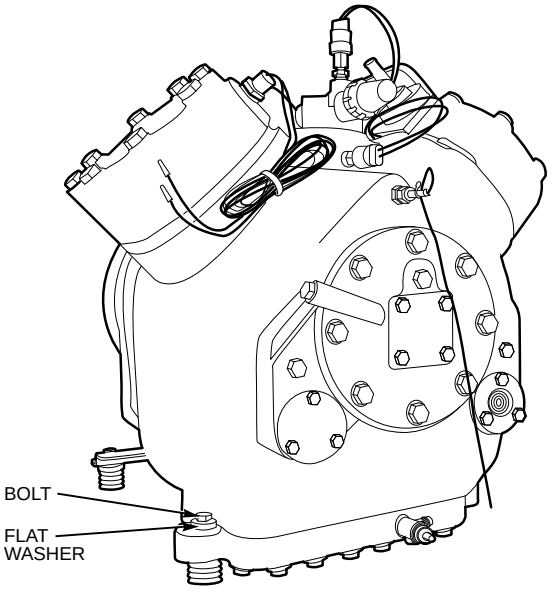


Fig. 4 — Compressor Mounting View

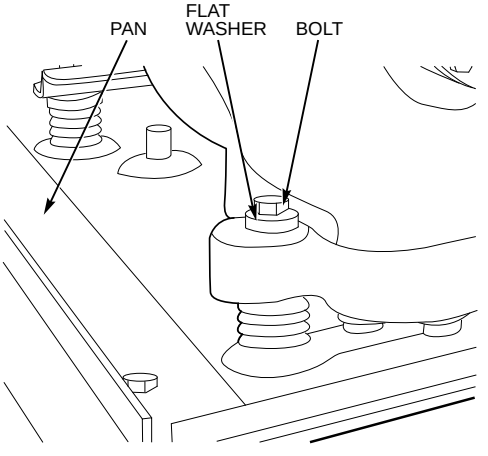


Fig. 5 — Compressor Mounting Bolt

PREPARATION FOR WINTER SHUTDOWN — *Do not shut off control power disconnect during off-season shutdown.*

At end of cooling season:

1. Drain the water from the system.
2. Replace the drain plug and add 2 gal. (8 L) of ethylene glycol to the cooler to prevent freezing of any remaining water in system. Glycol can be added through the vent on top of cooler.
3. Open one of the thermistor connections to allow air to escape the vessel and the glycol to enter.
4. For units with optional cooler heaters, remove fuse no. 1 (FU1).
5. At the beginning of the next cooling season, replace FU1 (if removed), refill cooler, and add recommended inhibitor.

Step 4 — Make Electrical Connections — The electrical characteristics of the available power supply must agree with the unit nameplate rating. Supply voltage must be within the limits shown. The control box is divided into field power side on the right and control power supply on the left. See Fig. 6.

FIELD POWER CONNECTIONS (See Fig. 7) — All power wiring must comply with applicable local and national codes. Install field-supplied, branch circuit fused disconnect(s) of a type that can be locked off or open. Disconnect(s) must be located within sight from and readily accessible from unit in compliance with NEC Article 440-14 or local codes. See Tables 3-6 for unit electrical data.

All field main power enters the unit through the control box at the left end when facing the compressors. An access hole is under the control box. All units have a single location for power connection (except size 050-070, 208/230 units) to simplify the field power wiring. For all sizes, maximum wire size that the unit terminal block will accept is 500 kcmil. Unit may use copper, copper-clad aluminum, or aluminum conductors at all voltages.

For 208/230-3-60 units (sizes 050-070), parallel conductors are required. Power must be supplied by 6 parallel conductors for these units.

FIELD CONTROL POWER CONNECTIONS (See Fig. 7) — *For 208/230-, 460- and 575-3-60 units:* If the accessory transformer is not used, provide a single-phase power source for the control circuit through a field-supplied fused disconnect (per NEC or local code). This conductor *must be copper only.* Control power enters the control box through a ⅞-in. (22.2-mm) conduit connection located on the right side of the control section.

For 380-3-60 and 380/415-3-50 units: Control circuit voltage is taken from the line voltage, therefore, no additional power supply is required for the unit. If a separate power source is required for a particular application, disconnect the wires between the control and power terminal blocks.

For 346-3-50 Units: Provide a 230-1-50 power source for the control circuit through a field-supplied fused disconnect (per NEC or local code). This conductor *must be copper only.* Control power enters the control box through a ⅞-in. (22 mm) conduit connection located on the right side of the control section.

Units with a power supply of 208/230-, 460- and 575-3-60 require 115-1-60 control circuit power. Units with a power supply of 380-3-60 have 230-1-60 control circuit power, which is taken from the unit's power supply voltage. Units with a power supply of 380/415-3-50 have 230-1-50 control circuit power, which is also taken from the unit's power supply voltage. Units with a 346-3-50 power supply require a separate 230-1-50 control power source. For control circuit current draw, see Table 4.

Control circuit power draw includes the compressor crankcase heaters at 180 watts each, the cooler heaters (if equipped) at 210 watts each, and the electronic board heater at 120 watts. Sizes 040-050 have 2 cooler heaters; sizes 060 and 070 have 4 cooler heaters.

⚠ CAUTION

Crankcase and cooler heaters are all wired into the control circuit ahead of the control circuit switch. Therefore, they are always active even if the control circuit switch is OFF.

An interlock circuit for external safeties, such as the Chilled Water (Fluid) Flow Switch (CWFS), Remote On-Off, and Chilled Water (Fluid) Pump Interlock (CWPI) is provided between terminals TB6-3 and TB6-4 for field use. To use this circuit, remove the factory jumper and install the switches.

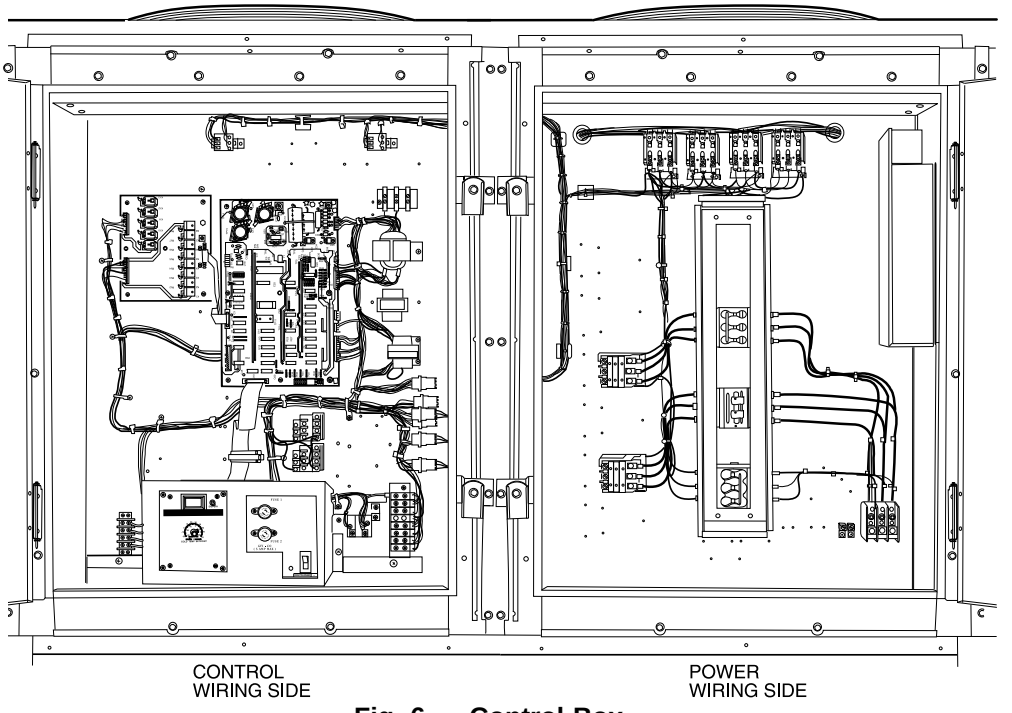


Fig. 6 — Control Box

Step 5 — Install Accessories

ELECTRICAL — Several electrical accessories are available to provide the following optional features (for details, refer to the Controls and Troubleshooting book):

- Accessory temperature reset board and accessory thermistor (used for any of the following types of temperature reset):
  - — Return-fluid temperature reset
  - — Space temperature reset (requires accessory thermistor)
  - — Outdoor-air temperature reset (requires accessory thermistor)
- Chilled fluid flow switch

LOW-AMBIENT OPERATION — If operating temperatures below 0° F (−18 C) are expected, refer to separate installation instructions for low-ambient operation, Motormaster® III control.

HOT GAS BYPASS — Hot gas bypass usually is *not* recommended because it results in application of equipment out of its normal design application range. However, if its use is required, the appropriate hot gas bypass package may be used. For installation details, refer to separate instructions supplied with the accessory package.

MISCELLANEOUS ACCESSORIES — For applications requiring special accessories, the following packages are available: Condenser Hail Guard, Gage Panel, Security Grille Package, Condenser Fan Sound Reduction Kit, and CPCS (Compressor Protection Control System) packages.

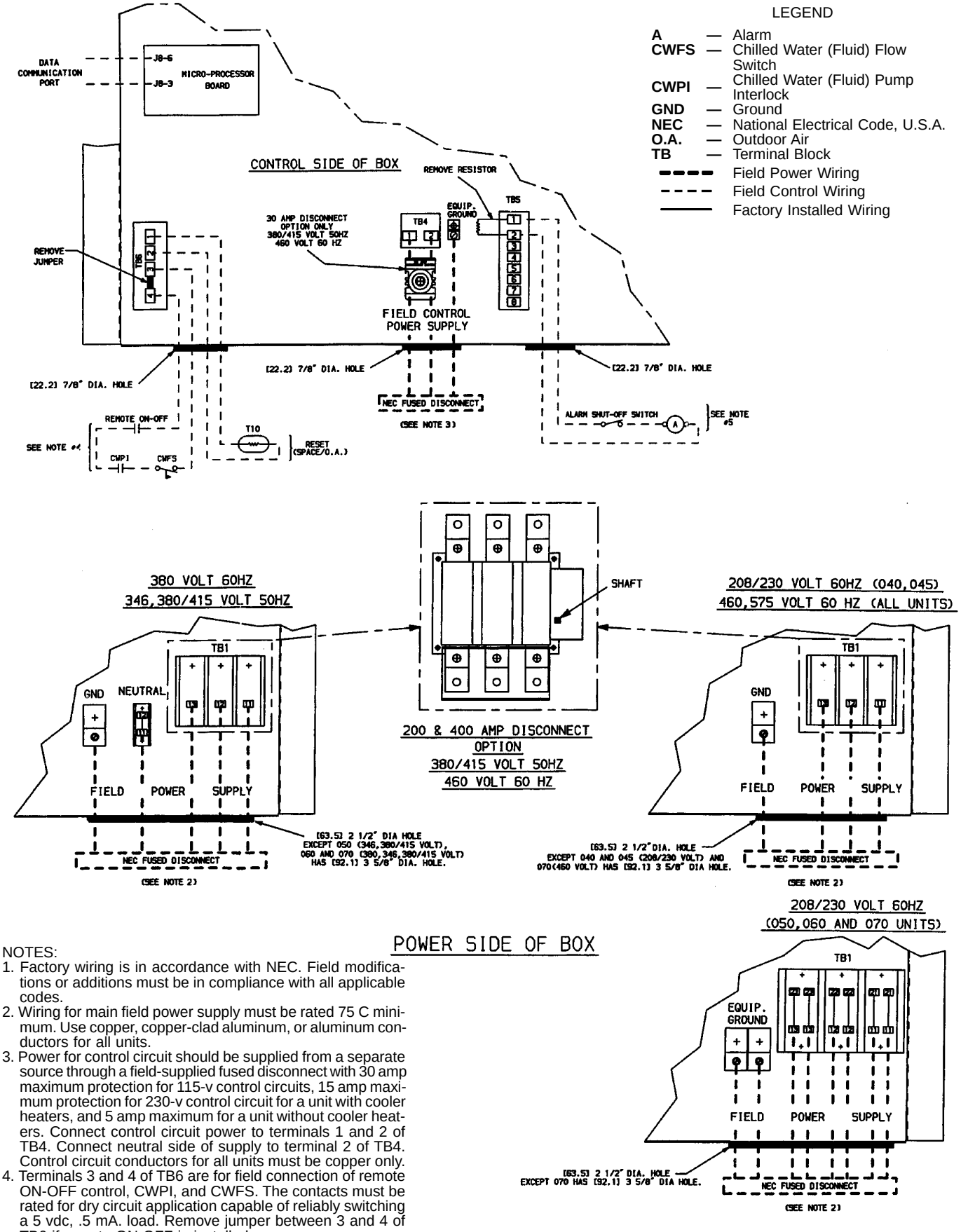
PRE-START-UP

IMPORTANT: Before beginning Pre-Start-Up or Start-Up, complete Start-Up Checklist for Flotronic™ Chiller Systems at center of this publication. The Checklist assures proper start-up of a unit and provides a record of unit condition, application requirements, system information, and operation at initial start-up.

Do not attempt to start the chiller until following checks have been completed.

System Check

1. Check all auxiliary components, such as the chilled fluid circulating pump, air-handling equipment, or other equipment to which the chiller supplies liquid. Consult manufacturer's instructions. If the unit has field-installed accessories, be sure all are properly installed and wired correctly. Refer to unit wiring diagrams.
2. Backseat (open) compressor suction and discharge shutoff valves. Close valves one turn to allow refrigerant pressure to reach the test gages.
3. Open liquid line service valves.
4. Fill the chiller fluid circuit with clean water (with recommended inhibitor added) or other noncorrosive fluid to be cooled. Bleed all air out of high points of system. An air vent is included with the cooler. If outdoor temperatures are expected to be below 32 F (0° C), sufficient inhibited ethylene glycol (or other suitable corrosion-inhibitive antifreeze) should be added to the chiller fluid circuit to prevent possible freeze-up.



NOTES:

1. Factory wiring is in accordance with NEC. Field modifications or additions must be in compliance with all applicable codes.
2. Wiring for main field power supply must be rated 75 C minimum. Use copper, copper-clad aluminum, or aluminum conductors for all units.
3. Power for control circuit should be supplied from a separate source through a field-supplied fused disconnect with 30 amp maximum protection for 115-v control circuits, 15 amp maximum protection for 230-v control circuit for a unit with cooler heaters, and 5 amp maximum for a unit without cooler heaters. Connect control circuit power to terminals 1 and 2 of TB4. Connect neutral side of supply to terminal 2 of TB4. Control circuit conductors for all units must be copper only.
4. Terminals 3 and 4 of TB6 are for field connection of remote ON-OFF control, CWPI, and CWFS. The contacts must be rated for dry circuit application capable of reliably switching a 5 vdc, .5 mA. load. Remove jumper between 3 and 4 of TB6 if remote ON-OFF is installed.
5. The maximum load allowed for the remote alarm circuit is 75 va sealed, 360 va inrush at 115 or 230 v, depending on model. Remove resistor across terminals 1 and 2 of TB5 when using remote alarm.
6. Dimensions in [ ] are millimeters.

Fig. 7 — Field Wiring

Table 3 — Unit Electrical Data

30GT UNIT SIZE	VOLTAGE			STANDARD CONDENSER FAN								HIGH STATIC CONDENSER FAN							
				MCA		MOCP		Rec Fuse Size		ICF		MCA		MOCP		Rec Fuse Size		ICF	
	Nameplate V-Hz (3 phase)	Supplied*		XL	PW	XL	PW	XL	PW	XL	PW	XL	PW	XL	PW	XL	PW	XL	PW
		Min	Max																
040	208/230-60	187	253	177.2	177.2	225	225	200	200	437.3	299.3	211.2	211.2	250	250	250	250	471.3	333.3
	460-60	414	506	101.2	101.2	100	100	100	100	219.8	149.5	114.2	114.2	125	125	125	125	232.2	162.5
	575-60	518	633	100.0	100.0	100	100	90	90	162.4	113.7	107.2	107.2	125	125	100	100	169.6	120.9
	380-60	342	418	100.0	100.0	125	100	110	100	241.2	163.9	114.0	114.0	125	125	125	125	255.2	177.9
	346-50	325	380	107.0	107.0	150	150	125	125	297.9	198.9	124.2	124.2	150	150	125	125	315.1	216.1
	380/415-50	342	440	102.9	103.2	125	125	125	125	271.4	181.1	118.3	118.6	150	150	150	150	286.8	196.5
045	208/230-60	187	253	204.4	204.4	250	250	225	225	538.3	360.3	238.4	238.4	300	300	300	300	572.3	394.3
	460-60	414	506	101.3	101.6	125	125	125	125	269.8	179.5	114.3	114.3	150	150	150	150	282.8	192.5
	575-60	518	633	100.0	100.0	125	100	100	100	206.4	139.8	107.2	107.2	125	125	110	100	213.6	147.0
	380-60	342	418	107.1	105.0	150	150	125	125	297.2	196.9	121.1	118.0	150	150	150	150	311.2	210.9
	346-50	325	380	129.8	129.8	175	175	150	150	342.5	230.5	147.0	147.0	200	200	150	150	359.7	247.7
	380/415-50	342	440	115.9	119.6	150	150	150	150	337.4	210.7	131.3	135.0	175	175	150	150	352.8	226.1
050	208/230-60	187	253	247.1	247.1	350	350	300	300	620.1	418.1	281.1	281.1	350	350	350	350	654.1	452.1
	460-60	414	506	114.3	118.0	150	150	125	150	308.8	209.1	128.3	131.0	175	175	150	150	321.8	222.1
	575-60	518	633	100.6	100.0	125	100	125	100	226.1	152.9	108.0	107.2	125	125	125	125	233.3	160.1
	380-60	342	418	126.9	127.8	175	175	150	150	341.1	228.5	140.9	141.8	175	175	175	175	355.1	242.5
	346-50	325	380	170.8	170.8	250	250	200	200	453.4	300.4	188.0	188.0	250	250	175	175	470.6	317.6
	380/415-50	342	440	142.4	147.4	200	200	175	175	405.6	269.5	157.8	162.8	225	225	175	175	421.0	284.9
060	208/230-60	187	253	328.5	328.5	450	450	400	400	828.8	552.8	378.3	378.3	500	500	450	450	878.6	602.6
	460-60	414	506	142.0	147.0	200	200	175	175	410.6	274.5	161.0	166.0	225	225	200	200	429.6	293.5
	575-60	518	633	125.4	121.0	175	150	150	150	336.8	218.7	136.2	131.8	175	175	175	175	347.6	229.5
	380-60	342	418	174.5	176.6	250	250	200	200	458.0	306.2	195.5	197.6	250	250	225	225	479.0	327.2
	346-50	325	380	205.3	205.3	250	250	250	250	487.9	334.9	231.1	231.1	300	300	225	225	513.7	360.7
	380/415-50	342	440	167.9	173.5	225	225	200	200	431.1	295.6	191.0	196.6	250	250	225	225	454.2	318.7
070	208/230-60	187	253	369.5	369.5	500	500	450	450	869.8	593.8	475.5	475.5	600	600	500	500	919.6	643.6
	460-60	414	506	166.0	171.6	225	225	200	200	429.2	293.7	196.0	190.4	250	250	225	225	448.2	312.7
	575-60	518	633	148.9	141.5	200	175	175	175	353.5	239.2	159.7	152.3	200	200	175	175	364.3	250.0
	380-60	342	418	200.7	202.3	250	250	225	225	484.2	331.9	221.7	223.3	300	300	250	250	505.2	352.9
	346-50	325	380	215.6	215.6	250	250	250	250	498.2	345.2	241.4	241.4	300	300	225	225	524.0	371.0
	380/415-50	342	440	189.7	195.4	250	250	225	225	452.9	317.5	212.8	218.5	275	275	250	250	455.2	340.6

Table 4 — Control Circuit

UNIT POWER	CONTROL POWER			AMPS
V-Ph-Hz	V-Ph-Hz	Min	Max	
208/230-3-60	115-1-60	104	127	30
460-3-60	115-1-60	104	127	30
575-3-60	115-1-60	104	127	30
380-3-60	230-1-60	207	254	15/5†
346-3-50	230-1-50	198	254	15/5†
380/415-3-50	230-1-50	198	254	15/5†

LEGEND AND NOTES FOR ELECTRICAL DATA FOR TABLES 3 - 6

LEGEND

FLA — Full Load Amps (Fan Motors)
ICF — Maximum Instantaneous Current Flow during starting (the point in the starting sequence where the sum of the LRA for the starting compressor, plus the total RLA for all running compressors, plus the total FLA for all running fan motors is maximum)
kW — Total condenser fan motor power input
LRA — Locked Rotor Amps
MCA — Minimum Circuit Amps (for wire sizing) — complies with NEC Section 430-24
MOCP — Maximum Overcurrent Protective Device Amps
NEC — National Electrical Code, U.S.A.
PW — Part Wind Start
Rec Fuse Size — Recommended dual-element fuse amps: 150% of largest compressor RLA plus 100% of sum of remaining compressor RLAs. Size up to the next larger standard fuse size.
RLA — Rated Load Amps (Compressors)
XL — Across-the-Line Start

*Units are suitable for use on electrical systems where voltage supplied to the unit terminals is not below or above the listed minimum and maximum limits. Maximum allowable phase imbalance is voltage, 2%; amps, 10%.
†First value is for chiller with cooler heater. Second value (if applicable) is for chiller without cooler heater.
**Numbers in ( ) indicate quantity.

NOTES:
1. All units have single point primary power connection. Main power must be supplied from a field-supplied disconnect.
2. The unit control circuit power (115 v, 1-ph for 208/230-, 460-, and 575-v units; 230 v, 1-ph for all other voltages) must be supplied from a separate source, through a field-supplied disconnect. The control circuit transformer accessory may be applied to power from primary unit power.
3. Crankcase and cooler heaters are wired into the control circuit so they are always operable as long as the control circuit power supply disconnect is on, even if any safety device is open or the unit ON-OFF circuit switch is off.
4. Units have the following power wiring terminal blocks and parallel conductors:

30GT UNIT SIZE	VOLTAGE	TERMINAL BLOCKS	PARALLEL CONDUCTORS
040 to 070	208/230	1	3 (040,045),6 (050-070)
	460	1	3
	575	1	3
	380	1	3
	346	1	3
	380/415	1	3

5. Maximum incoming wire size for each terminal block is 500 kcmil.
6. Power draw of control circuits includes both crankcase heaters (where used) and cooler heaters. Each compressor has a crankcase heater which draws 180 watts of power.

   Units ordered with cooler heater option have 2 cooler heaters (040-050) or 4 cooler heaters (060,070), 210 w each, and a 120-w circuit board heater.

Table 5 — Compressor Electrical Data

30GT UNIT SIZE	NAMEPLATE VOLTAGE	COMPRESSOR NUMBERS					
		A1		A2		B1	
		RLA	LRA	RLA	LRA	RLA	LRA
040-XL	208/230-3-60	67.9	345	—	—	67.9	345
	460-3-60	34.6	173	—	—	34.6	173
	575-3-60	28.8	120	—	—	28.8	120
	380-3-60	34.6	191	—	—	34.6	191
	346-3-50	33.3	191	—	—	44.9	247
	380/415-3-50	34.6	173	—	—	43.6	223
040-PW	208/230-3-60	67.9	207	—	—	67.9	207
	460-3-60	33.3	104	—	—	33.3	104
	575-3-60	28.2	72	—	—	28.2	72
	380-3-60	33.3	115	—	—	33.3	115
	346-3-50	33.3	115	—	—	44.9	148
	380/415-3-50	33.3	104	—	—	44.9	134
045-XL	208/230-3-60	67.9	345	—	—	89.7	446
	460-3-60	34.6	173	—	—	43.6	223
	575-3-60	28.8	120	—	—	36.5	164
	380-3-60	34.6	191	—	—	45.5	247
	346-3-50	44.9	247	—	—	53.8	280
	380/415-3-50	43.6	223	—	—	46.8	280
045-PW	208/230-3-60	67.9	207	—	—	89.7	268
	460-3-60	33.3	104	—	—	44.9	134
	575-3-60	28.2	72	—	—	33.3	98
	380-3-60	33.3	115	—	—	44.9	148
	346-3-50	44.9	148	—	—	53.8	168
	380/415-3-50	44.9	134	—	—	48.7	152
050-XL	208/230-3-60	89.7	446	—	—	106.4	506
	460-3-60	43.6	223	—	—	46.8	253
	575-3-60	36.5	164	—	—	40.4	176
	380-3-60	45.5	247	—	—	52.6	280
	346-3-50	53.8	280	—	—	79.5	382
	380/415-3-50	46.8	280	—	—	65.4	345
050-PW	208/230-3-60	89.7	268	—	—	106.4	304
	460-3-60	44.9	134	—	—	48.7	152
	575-3-60	33.3	98	—	—	33.3	106
	380-3-60	44.9	148	—	—	53.8	168
	346-3-50	53.8	168	—	—	79.5	229
	380/415-3-50	48.7	152	—	—	67.9	207
060-XL	208/230-3-60	106.4	506	—	—	147.7	690
	460-3-60	46.8	253	—	—	65.4	345
	575-3-60	40.4	176	—	—	57.1	276
	380-3-60	52.6	280	—	—	78.8	382
	346-3-50	79.5	382	—	—	79.5	382
	380/415-3-50	65.4	345	—	—	67.9	345
060-PW	208/230-3-60	106.4	304	—	—	147.4	414
	460-3-60	48.7	152	—	—	65.4	207
	575-3-60	33.3	106	—	—	57.1	165
	380-3-60	53.8	168	—	—	78.8	229
	346-3-50	79.5	229	—	—	79.5	229
	380/415-3-50	67.9	207	—	—	65.4	207
070-XL	208/230-3-60	147.7	690	—	—	147.4	690
	460-3-60	65.4	345	—	—	65.4	345
	575-3-60	57.1	276	—	—	57.1	276
	380-3-60	78.8	382	—	—	78.8	382
	346-3-50	44.9	247	44.9	247	79.5	382
	380/415-3-50	43.6	223	43.6	223	65.4	345
070-PW	208/230-3-60	147.4	414	—	—	147.4	414
	460-3-60	67.9	207	—	—	67.9	207
	575-3-60	53.8	165	—	—	53.8	165
	380-3-60	79.5	229	—	—	79.5	229
	346-3-50	44.9	148	44.9	247	79.5	229
	380/415-3-50	44.9	134	44.9	223	67.9	207

See Legend and Notes on page 11.

Table 6 — Condenser Fan Electrical Data

30GT UNIT SIZE	NAMEPLATE VOLTAGE V-Hz (3 Phase)	STANDARD CONDENSER FAN					HIGH-STATIC CONDENSER FAN				
		No.	Hp	kW	FLA (ea)**	LRA (ea)**	No.	Hp	kW	FLA (ea)	LRA (ea)
040	208/230-60 460-60 575-60 380-60 346-50 380/415-50	4	1	0.746	(2) 6.7, (2) 5.5 (2) 3.3, (2) 2.8 (4) 3.4 (4) 3.9 (4) 4.4 (4) 3.5	(2) 31.6, (2) 30.0 (2) 31.6, (2) 30.0 (4) 30.0 (4) 20.9 (4) 20.9 (4) 30.0	4	5	3.73	14.6 6.3 5.2 7.4 8.7 7.3	41.6 41.6 42.0 54.0 53.0 41.0
045	208/230-60 460-60 575-60 380-60 346-50 380/415-50	4	1	0.746	(2) 6.7, (2) 5.5 (2) 3.3, (2) 2.8 (4) 3.4 (4) 3.9 (4) 4.4 (4) 3.5	(2) 31.6, (2) 30.0 (2) 31.6, (2) 30.0 (4) 30.0 (4) 20.9 (4) 20.9 (4) 30.0	4	5	3.73	14.6 6.3 5.2 7.4 8.7 7.3	41.6 41.6 42.0 54.0 53.0 41.0
050	208/230-60 460-60 575-60 380-60 346-50 380/415-50	4	1	0.746	(2) 6.7, (2) 5.5 (2) 3.3, (2) 2.8 (4) 3.4 (4) 3.9 (4) 4.4 (4) 3.5	(2) 31.6, (2) 30.0 (2) 31.6, (2) 30.0 (4) 30.0 (4) 20.9 (4) 20.9 (4) 30.07.3	4	5	3.73	14.6 6.3 5.2 7.4 8.7 7.3	41.6 41.6 42.0 54.0 53.0 41.0
060	208/230-60 460-60 575-60 380-60 346-50 380/415-50	6	1	0.746	(4) 6.7, (2) 5.5 (4) 3.3, (2) 2.8 (6) 3.4 (6) 3.9 (6) 4.4 (6) 3.5	(4) 31.6, (2) 30.0 (4) 31.6, (2) 30.0 (6) 30.0 (6) 20.9 (6) 20.9 (6) 30.0	6	5	3.73	14.6 6.3 5.2 7.4 8.7 7.3	41.6 41.6 42.0 54.0 53.0 41.0
070	208/230-60 460-60 575-60 380-60 346-50 380/415-50	6	1	0.746	(4) 6.7, (2) 5.5 (4) 3.3, (2) 2.8 (6) 3.4 (6) 3.9 (6) 4.4 (6) 3.5	(4) 31.6, (2) 30.0 (4) 31.6, (2) 30.0 (6) 30.0 (6) 20.9 (6) 20.9 (6) 30.0	6	5	3.73	14.6 6.3 5.2 7.4 8.7 7.3	41.6 41.6 42.0 54.0 53.0 41.0

See Legend and Notes on page 11.

5. Check tightness of all electrical connections.
6. Oil should be visible in the compressor sight glasses. See Fig. 8. An acceptable oil level in the compressor is from ⅛ to ⅜ of sight glass. Adjust the oil level as required. No oil should be removed unless the crankcase heater has been energized for at least 24 hours. See Oil Charge section on page 23 for Carrier-approved oils.
7. Electrical power source must agree with unit nameplate.
8. *Crankcase heaters must be firmly locked into compressors, and must be on for 24 hours prior to start-up.*
9. Fan motors are 3 phase. Check rotation of fans during the quick test. Fan rotation is clockwise as viewed from top of unit. If fan is not turning clockwise, reverse 2 of the power wires.
10. Check compressor suspension. Snubber washers (for noise suppression) can be moved with finger pressure.
11. Perform quick test to verify proper settings. See Controls and Troubleshooting literature for more details.

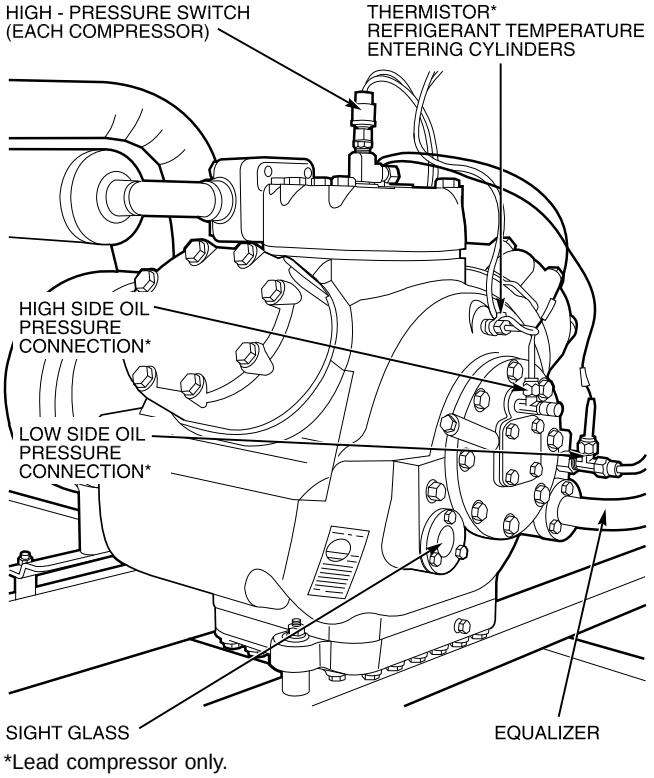
Quick Test (See Fig. 9 and Table 7) — *Both main power and control circuit power must be on.*

The quick test program utilizes a 2-digit LED display (Fig. 9) on set point board to show status of all input and output signals to microprocessor control. Display action and quick test procedure are described as follows:

The quick test is a 42-step program that provides a means of checking all input and output signals of microprocessor control prior to unit start-up. Check ensures that all control options, thermistors, and status switches are in proper working order.

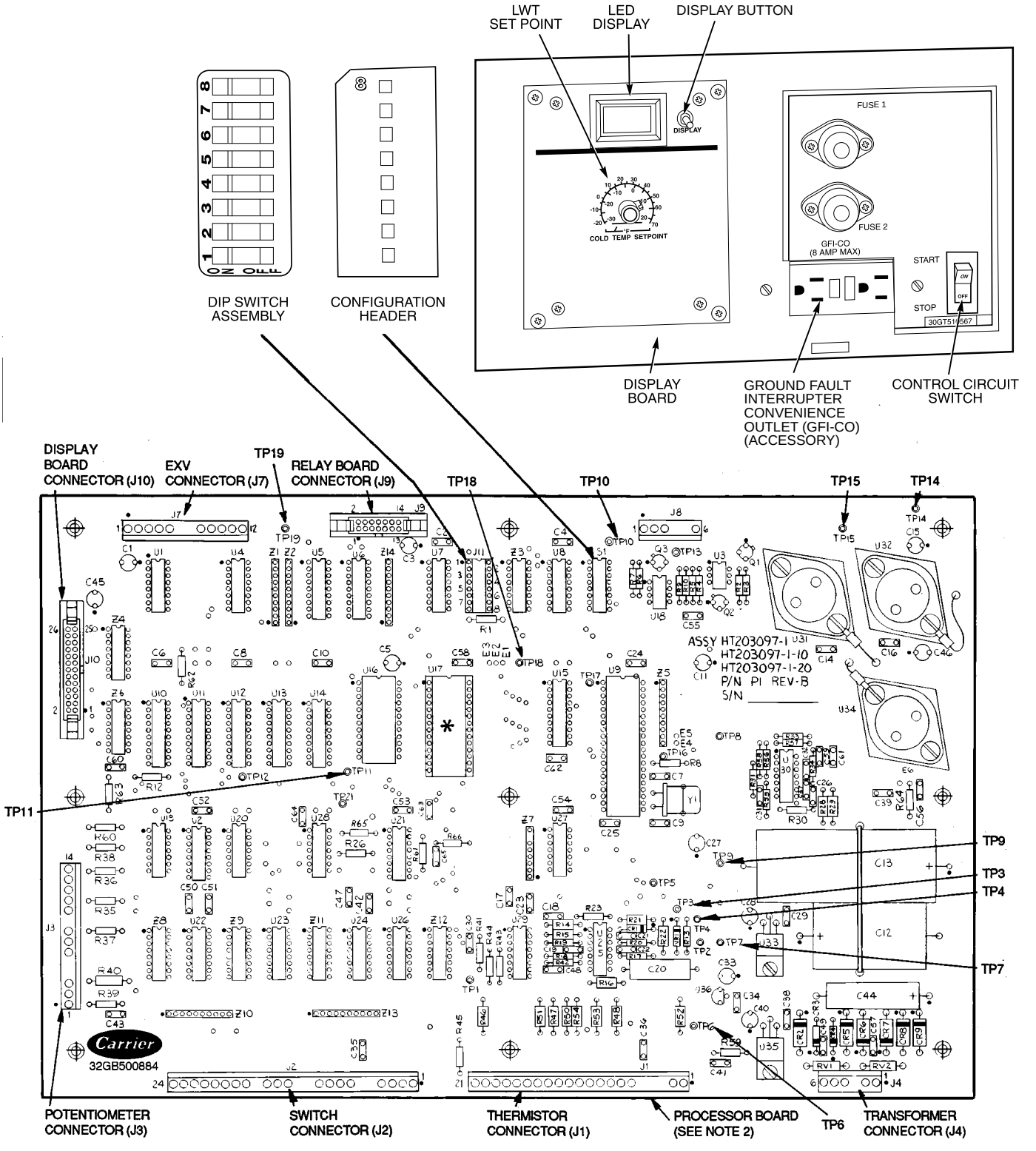
To initiate the quick test program, first turn unit control switch to the ON position. When a **20** appears in display, immediately press display button *once*. An **88** will appear in display and alarm light will be energized; this indicates that microprocessor in control system is ready to run quick test program.

IMPORTANT: Do not allow unit control circuit to remain energized with **20** showing in display for more than 2 minutes. If display button is not pressed within this time, control will attempt to start unit.


HIGH - PRESSURE SWITCH (EACH COMPRESSOR)
THERMISTOR* REFRIGERANT TEMPERATURE ENTERING CYLINDERS
HIGH SIDE OIL PRESSURE CONNECTION*
LOW SIDE OIL PRESSURE CONNECTION*
SIGHT GLASS
EQUALIZER

*Lead compressor only.

Fig. 8 — Compressor Connections (Lead Compressor Shown)



*EPROM HT207101-1-XX.

LEGEND

DIP	—	Dual In-line Package
EPROM	—	Electronic Programmable Read-Only Memory
EXV	—	Electronic Expansion Valve
LED	—	Light-Emitting Diode
LWT	—	Leaving-Water (Fluid) Temperature
TP	—	Test Pin

NOTES:
1. Refer to Controls and Troubleshooting publication for details.
2. Processor board is rotated 90 degrees counterclockwise from position shown when installed in unit.
3. Do not remove label covering EPROM. Removal causes program to be erased.

Fig. 9 — Center of Flotronic™ Control System

Table 7 — Quick Test

SECTION A. — Configuration and Switch Check

QUICK TEST STEP NO.	NORMAL DISPLAY	STEP DESCRIPTION	HEADER POSITION OR CONTROL SWITCH
1.	00	Type Unit — Air-Cooled Chiller	Configuration Header: 1 and 2
2.	2 or 3	No. of Compressors	Configuration Header: 3, 4, and 5
		2 =040-060 (50 Hz), 040-070 (60 Hz)	
		3 = 070 (50 Hz)	
3.	1 or 2	No. of Unloaders	DIP Switches 6 and 7
		1 = Switch 6 On, Switch 7 Off	
		2 = Switch 6 Off, Switch 7 On	
4.	0 or 1	0 = Water	DIP Switch 8
		1 = Brine*	
5.	1 or 0	1 = EXV	Configuration Header: 6
		0 = TXV	
6.	50 or 60	50 = 50 Hz	Configuration Header: 7
		60 = 60 Hz	
7.	0 or 1	0 = External Reset	DIP Switch 1
		1 = Return Fluid Reset	
8.	0 or 1	0 = Reset Disabled	DIP Switch 2
		1 = Reset Enabled	
9.	0 or 1	0 = Pulldown Disabled	DIP Switch 3
		1 = Pulldown Enabled	
10.	0 or 1	0 = Demand Limit Disabled	DIP Switch 5
		1 = Demand Limit Enabled	
11.	0 or 1	0 = Remote On-Off — Switch/Jumper Open	TB6-3 and TB6-4
		1 = Remote On-Off — Switch/Jumper Closed	
12.	0 or 1	0 = Loss-of-Charge Switch A Open	Circuit A Loss-of-Charge Switch
		1 = Loss-of-Charge Switch A Closed	
13.	0 or 1	0 = Loss-of-Charge Switch B Open	Circuit B Loss-of-Charge Switch
		1 = Loss-of-Charge Switch B Closed	
14.	0 or 1†	0 = Low Oil Pressure Switch A Open	Circuit A Low Oil Pressure Switch
		1 = Low Oil Pressure Switch A Closed	
15.	0 or 1†	0 = Low Oil Pressure Switch B Open	Circuit B Low Oil Pressure Switch
		1 = Low Oil Pressure Switch B Closed	

(Quick test continued on page 16; see page 17 for legend and notes.)

Table 7 — Quick Test 88 (cont)

SECTION B. — Thermistor and Potentiometer Checkout

QUICK TEST STEP NO.	NORMAL DISPLAY	STEP DESCRIPTION	THERMISTOR OR POTENTIOMETER
1.6.	1	1 — Thermistor OK 0 — Thermistor Faulty	T1 — Cooler Leaving Fluid Thermistor
1.7.	1	1 — Thermistor OK 0 — Thermistor Faulty	T2 — Cooler Entering Fluid Thermistor
1.8.	1	1 — Thermistor OK 0 — Thermistor Faulty	T3 — Saturated Condensing Thermistor, Circuit A
1.9.	1	1 — Thermistor OK 0 — Thermistor Faulty	T4 — Saturated Condensing Thermistor, Circuit B
2.0.	1 or 0 **	1 — Thermistor OK 0 — Thermistor Faulty or Not Used	T5 — Evaporator Refrigerant Thermistor, Circuit A (EXV Units)
2.1.	1 or 0 **	1 — Thermistor OK 0 — Thermistor Faulty or Not Used	T6 — Evaporator Refrigerant Thermistor, Circuit B (EXV Units)
2.2.	1 or 0 **	1 — Thermistor OK 0 — Thermistor Faulty or Not Used	T7 — Compressor Thermistor, Circuit A (EXV Units)
2.3.	1 or 0 **	1 — Thermistor OK 0 — Thermistor Faulty or Not Used	T8 — Compressor Thermistor, Circuit B (EXV Units)
2.4.	1 or 0	1 — Thermistor OK 0 — Thermistor Faulty or Not Used	T10 — Accessory Remote Thermistor
2.5.	1	1 — Potentiometer OK 0 — Potentiometer Faulty	P1 — Leaving Fluid Set Point Potentiometer
2.6.	0	No Significance	—
2.7.	1 or 0	1 — Potentiometer OK 0 — Potentiometer Faulty or Option Not Used	P3 — Accessory Reset Limit Potentiometer
2.8.	1 or 0	1 — Potentiometer(s) OK 0 — Potentiometer(s) Faulty or Option Not Used	P4 — Accessory Demand Limit Potentiometer(s)
2.9.	1 or 0	1 — Potentiometer OK 0 — Potentiometer Faulty or Option Not Used	P5 — Accessory Reset Ratio Potentiometer
3.0.	1 or 0	1 — Potentiometer OK 0 — Potentiometer Faulty or Option Not Used	P6 — Accessory Reset Set Point Potentiometer

Table 7 — Quick Test 88 (cont)

SECTION C. — Output Relay Check

QUICK TEST STEP NO.	NORMAL DISPLAY	STEP DESCRIPTION	RELAY NO.
3.1.	1	Energize First Stage of Condenser Fans 040-050 — OFM3 060, 070 — OFM3, OFM4	K11
3.2.	1	Energize Second Stage of Condenser Fans 040-050 — OFM4 060, 070 — OFM5, OFM6	K12
3.3.	1	Energize Liquid Line Solenoid Valve (TXV only), Circuit A	K9
3.4.	1	Energize Liquid Line Solenoid Valve (TXV only), Circuit B	K10
3.5.	0 → 1 → 0 ††	Energize Compressor A1, and OFM1	K1
3.6.	0 → 1 → 0 ††	Energize Compressor A2	K2
	0	No action 040-060 (50 Hz), 040-070 (60 Hz)	
3.7.	0	No Action	K3
3.8.	0	Energize Unloader A1	K4
3.9.	0 → 1 → 0 ††	Energize Compressor B1 and OFM2	K5
4.0.	0	No Action	K6
4.1.	0	No Action	K7
4.2.	0	Energize Unloader B1	K8

LEGEND

CPCS — Compressor Protection Control System
DIP — Dual In-Line Package
EXV — Electronic Expansion Valve
FIOP — Factory-Installed Option
OFM — Outdoor (Condenser) Fan Motor
TB — Terminal block
TXV — Thermostatic Expansion Valve

*Do not change select switch to brine on units that do not have modifications for brine. Special factory modifications are required. Contact Carrier for details.

† 1 is always displayed if oil pressure switch is not installed.

**Display is 1 for Flotronic™ EXV units only.

Display is 0 for Flotronic FIOP units (with TXV).

††Compressors will be energized for 10 seconds.

0 indicates open CPCS module contacts;

1 indicates closed CPCS module contacts.

IMPORTANT: If TB6-3 and TB6-4 jumper is not installed, chiller remains in standby mode. No compressors or fans start and Code 26 is displayed. This is not a fault code. If circuit between TB6-3 and TB6-4 is open, processor is programmed to initiate a shutdown and hold machine in standby. This feature makes remote shutdown of chiller easier.

For each step of the 42-step program, display button must be pressed *twice*. On first press, step number is displayed; second press initiates required action and code, as shown in Table 7.

NOTE: Step number is a numeral followed by a decimal point (a 2-digit number has a decimal point after *each* numeral). Action code number is one or 2 digits with no decimal point(s).

> IMPORTANT: Once quick test is initiated, display button must be pressed at least once every 10 minutes for control to remain in quick test mode. If button is not pressed within this time, control will attempt to start unit.

To recheck any step in quick test, control must be recycled by turning unit control circuit switch off for a few seconds, then on again. Restart quick test program as described above and proceed through quick test steps. Press display button *twice* for each step until step to be rechecked is reached.

The quick test program is divided into 3 sections as described below and shown in Table 7. For more detailed information refer to Controls and Troubleshooting publication.

QUICK TEST STEPS 1 - 15: UNIT CONFIGURATION — Microprocessor in unit control system is programmed by 2 switch assemblies located on processor board (Fig. 9). Configuration header is factory set and cannot be changed in the field. The DIP (dual in-line package) switch assembly contains 8 microswitches that must be set in accordance with various options and accessories selected. As shipped from factory, all DIP switches except those controlling pulldown option (switch no. 3), and compressor unloaders on compressor B1 (switch no. 7) are in OFF position. Switch no. 8 is in OFF position for water units, and in ON position for brine units. All DIP switches should be checked and set to proper position for options selected during quick test.

The DIP switch assembly, functions and display codes are shown in Fig. 9 and in Table 8. Refer to Controls and Troubleshooting publication for details.

QUICK TEST STEPS 16 - 30: THERMISTORS AND SET POINT POTENTIOMETERS — In these steps, microprocessor checks resistance values of all sensors and set point potentiometers to ensure they are functional and set within proper range for unit configuration.

Nominal resistance values for all sensors range from 363,000 to 216 ohms. Normal display code for good sensors and potentiometers is 1. Display code 0 indicates a faulty potentiometer, thermistor, or wiring. A 0 display indicates a particular option is not being used, i.e., demand limit not installed.

Tables 7 and 9 show set point potentiometer function, location, and quick test display codes.

QUICK TEST STEPS 31 - 42: OUTPUT RELAYS — These quick test steps allow microprocessor to check output signals from relay boards in unit control system. In addition, operation of all condenser fans and compressors is checked at each step.

Normal display code for steps 3.1. through 3.4. is 1. In steps 3.5. through 4.2., when appropriate, each compressor is started and allowed to run for approximately 10 seconds. At start-up 0 will appear, followed by a 1 in a few seconds. At end of 10-second test, code 0 returns to display indicating that test step has been successfully completed. Code 1 indicates that CPCS (compressor protection circuit) was tested.

Fan and compressor operating sequence for quick test steps 3.1. through 4.2. are shown in Table 7 and Fig. 10.

If quick test steps do not operate as described, a defect exists in one or more of the following: Relay being tested, electronic control, and/or unit wiring. Refer to Controls and Troubleshooting publication for additional information.

Table 8 — DIP Switch Functions

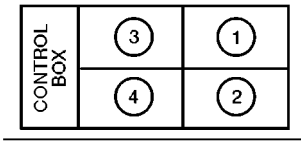
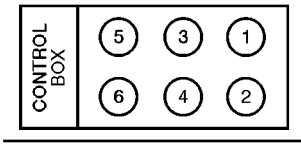
DIP SWITCH NO.	SELECTED FUNCTION*
1	Type of Reset
2	Reset
3	Pulldown Limit
4	Not Used
5	Demand Limit
6	1 Unloader
7	2 Unloaders
8	Brine

DIP — Dual, In-Line Package

*Refer to Table 7, quick test steps 3. through 1.0.

Table 9 — Potentiometer Locations

POTENTIOMETER	LOCATION
P1 — Leaving Fluid Set Point	Set Point Board (Standard)
P3 — Reset Limit Set Point	Accessory Board (Option)
P4 — Demand Limit	Accessory Board (Option)
P5 — Reset Ratio Set Point	Accessory Board (Option)
P6 — Reset Temp Set Point	Accessory Board (Option)

FAN ARRANGEMENT	FAN NO.	QUICK TEST DISPLAY NUMBER*	CONTROLLED BY
30GT040-050 	1	3.5.	Compressor No. A1
	2	3.9.	Compressor No. B1
	3	3.1.	First Stage of Condenser Fans
	4	3.2.	Second Stage of Condenser Fans
30GT060,070 	1	3.5.	Compressor No. A1
	2	3.9.	Compressor No. B1
	3,4	3.1.	First Stage of Condenser Fans
	5,6	3.2.	Second Stage of Condenser Fans

*During quick test only.

Fig. 10 — Condenser Fan Sequence

START-UP AND OPERATION

NOTE: Complete Start-Up Checklist at center of publication (pages CL-1 to CL-4) prior to starting unit.

Digital Display Action — The electronic control system uses a 2-digit LED (light-emitting diode) display located on display set point board (see Fig. 9) to show operational information and diagnostic codes.

When control ON-OFF switch is turned to ON position, display shows 20 for 2 minutes to indicate control is in initialization mode. Electronic expansion valve (EXV) will be closed as part of initialization sequence. This does not occur on FIOP (factory-installed option) units, where a conventional thermostatic expansion valve (TXV) is used.

After a 2-minute period, display turns off and unit is allowed to start. If button is pressed after the 20 has been removed from display, operational status codes or diagnostic information will be shown as long as button is held in. Code numbers on display will have following significance:

CODE NUMBER	OPERATIONAL STATUS
0-12	Capacity stage
20-26	Operational information
51-87	Overload information

Under normal operation, only stage number will be displayed. If an operational status code or an overload code is displayed, the display will rotate every 2 seconds and will display up to 3 numbers. Overload information will take priority over all other codes. The codes will be stored by the microprocessor as long as board is energized.

IMPORTANT: The memory is cleared when control power is removed.

Actual Start-Up — *Actual start-up should be done only under supervision of a qualified refrigeration mechanic.*

1. Be sure all service valves are open. The unit is shipped from the factory with the suction, discharge, and liquid line service valves closed.
2. Set leaving fluid temperature using LWT setpoint knob on front of control. No cooling range adjustment is necessary.
3. If accessory reset boards are used, set potentiometers properly. Refer to Controls and Troubleshooting book for details.
4. Start chilled fluid pump.
5. Turn ON-OFF switch to ON position. The display will read 20 . The machine checks all potentiometers and thermistors for valid readings. In approximately 2 minutes, the 20 reading is no longer displayed, and the machine is operational.

   Allow the unit to operate and confirm that everything is functioning properly. Check the leaving-fluid temperature and be sure that it agrees with the set point potentiometer P1. If the temperature setting does not agree, the set point can be compensated by shifting the control point slightly. If temperature reset is in effect, the leaving-fluid temperature may not agree with the set point.

Operating Limitations

TEMPERATURES (See Table 10) — If unit is to be used in an area with high solar radiation, mounted position should be such that control box is not exposed to direct solar radiation. Exposure to direct solar radiation could affect the temperature switch controlling cooler heaters.

Table 10 — Temperature Limits

TEMPERATURES	F	C
Maximum Ambient Temp	125	52
Minimum Ambient Temp	0	−18
Maximum Cooler EWT*	95	35
Maximum Cooler LWT	70	21
Minimum Cooler LWT†	40	4.5

EWT — Entering-Fluid Temp
LWT — Leaving-Fluid Temp

*For sustained operation, it is recommended that EWT *NOT* exceed 85 F (29.4 C).
†Unit and/or DIP switch requires modification below this temperature.

Low-Ambient Operation — If operating temperatures below 0° F (−18 C) are expected, refer to separate installation instructions for low-ambient operation/Motormaster® III control. Contact your Carrier representative for details.

High Cooler LWT (leaving fluid temperature) — During start-up with leaving-fluid temperatures above approximately 60 F (16 C), expansion valves (EXV and optional factory-installed TXV) will limit suction pressure to approximately 90 psig (620 kPa) to avoid overloading compressor.

Low Cooler LWT — Application of chillers within 39.9 F to 34 F (4.4 C to 1.1 C) temperature range is possible in some situations with proper field change of control configuration. This requires that DIP switch no. 8 (brine switch) of S1 on the processor board be set to ON position. See Tables 7 and 8.

⚠ WARNING

Do not operate with leaving-water temperature below 34 F (1.1 C). Application in the range 34 F to 15 F (1 C to −9.4 C) requires chiller with factory modification for brine duty.

Contact your Carrier representative for details.

VOLTAGE

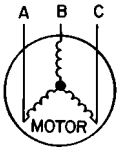
Main Power Supply — Minimum and maximum acceptable supply voltages are listed in Table 3.

Unbalanced 3-Phase Supply Voltage — Never operate a motor where a phase imbalance between phases is greater than 2%. To determine percentage of voltage imbalance:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from avg voltage}}{\text{average voltage}}$$

The maximum voltage deviation is the largest difference between a voltage measurement across 2 legs and the average across all 3 legs.

Example: Supply voltage is 240-3-60.



AB = 243 v
BC = 236 v
AC = 238 v

1. Determine average voltage:

$$\text{Average voltage} = \frac{243 + 236 + 238}{3}$$

$$= \frac{717}{3}$$

$$= 239 \text{ v}$$

2. Determine maximum deviation from average voltage:
   (AB) 243 - 239 = 4 v
   (BC) 239 - 236 = 3 v
   (AC) 239 - 238 = 1 v
   Maximum deviation is 4 v.
3. Determine % voltage imbalance:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{239}$$
$$= 1.7\%$$

This voltage imbalance is satisfactory as it is below the maximum allowable of 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately. Do not operate unit until imbalance condition is corrected.

Control Circuit Power— Electronic control includes logic to detect low control circuit voltage. Acceptable voltage range is shown in Table 4.

MINIMUM FLUID LOOP VOLUME — To obtain proper temperature control, loop fluid volume must be at least 3 gallons per ton (3.25 L per kW) of chiller nominal capacity for air conditioning and at least 6 gallons per ton (6.5 L per kW) for process applications or systems that must operate in low ambients (below 32 F [0° C]). Refer to application information in Product Data literature for details.

FLOW RATE REQUIREMENTS — Standard chillers should be applied with nominal flow rates approximating those listed in Table 11. Higher or lower flow rates are permissible to obtain lower or higher temperature rises. Minimum flow rates *must be exceeded* to assure turbulent flow and proper heat transfer in the cooler.

⚠ CAUTION

Operation below minimum flow could subject tubes to frost pinching in tube sheet, resulting in failure of cooler.

Consult application data and job design requirements to determine flow rate requirements for particular installation.

Table 11 — Nominal and Minimum Cooler Fluid Flow Rates

30GT UNIT SIZE	NOMINAL FLOW RATE*		MINIMUM FLOW RATE (See Notes)	
	Gpm	L/s	Gpm	L/s
040	86	5.43	36.8	2.38
045	101	6.37	37.7	2.38
050	123	7.76	37.7	2.38
060	151	9.53	47.5	3.00
070	173	10.91	47.5	3.00

LEGEND

ARI — Air Conditioning and Refrigeration Institute (U.S.A.)
N — Liters per kW
V — Gallons per ton

*Nominal flow rates required at ARI conditions 44 F (7 C) leaving-fluid temperature, 54 F (12 C) entering-fluid temperature, 95 F (35 C) ambient. Fouling factor .00025 $ft^2 \cdot hr \cdot F/Btu$ (.000044 $m^2 \cdot K/W$).

NOTES:
1. Minimum flow based on 1.0 fps (0.30 m/s) velocity in cooler without special cooler baffling.
2. Minimum Loop Volumes:
   Gallons = V x ARI Cap. (tons)
   Liters = N x ARI Cap. (kW)

APPLICATION	V	N
Normal Air Conditioning	3	3.25
Process Type Cooling	6 to 10	6.5 to 10.8
Low Ambient Unit Operation	6 to 10	6.5 to 10.8

Operation Sequence — During unit off cycle, crankcase heaters are energized. If ambient temperature is below 36 F (2 C), cooler heaters and a microprocessor board heater are also energized.

When control ON-OFF switch is turned to ON position, control first goes through a 2-minute initialization period, during which the display continuously shows 20. Ninety (90) seconds after 20 leaves display, control begins to bring on compressors. Rate at which compressors are started depends on leaving chilled fluid temperature and rate of change of leaving-fluid temperature.

On all units, an automatic lead-lag feature in control system determines by random selection either circuit A or B to start first.

At first call for cooling, microprocessor starts first compressor, deenergizes crankcase heater, and starts one condenser fan.

UNITS WITH EXV — The EXV remains closed for 10 seconds to purge cooler and suction line of any liquid refrigerant that may have migrated to these areas during off period. After 10 seconds, EXV starts to open. As more cooling is required, control brings on additional stages of capacity. Loading sequence for compressors is shown in Table 12.

Lag compressor will shut down, and lead compressor will continue to run. After lag compressor has shut down, the EXV is signaled to close. Lead compressor remains on until EXV is less than 600 steps open, and either the saturated suction temperature is less than 25 F (−4 C) as sensed by thermistor T5 or T6, or one minute has elapsed.

UNITS WITH STANDARD TXV — Liquid line solenoid valve is not energized for first 10 seconds of compressor operation. This is called pumpout cycle.

Microprocessor determines how rapidly capacity stages are added or subtracted, based on deviation from leaving chilled fluid temperature set point and rate of change of leaving-fluid temperature. If fluid temperature is very warm and pulldown option is being used, microprocessor limits rate of temperature drop of leaving fluid to 1° F (0.56° C) per minute to avoid high peak kW charges. If the capacity is being limited by pulldown, the control display shows 24 when the display button is pressed. Once capacity has been satisfied, the unit starts to shut down.

Lag compressor will be shut down and lead compressor continues to run for 10 seconds to purge cooler of any refrigerant.

LOAD SHED — If load shed option is being used, control limits maximum capacity to load shed input value. Refer to Controls and Troubleshooting publication for details. If capacity is limited by a load shed signal, display shows 22 when display button is pressed.

TEMPERATURE RESET — If temperature reset is being used, microprocessor adjusts leaving-fluid temperature to obtain greater part-load efficiency. Refer to Controls and Troubleshooting book for details. If leaving-fluid temperature is being reset, display shows 21 when the display button is pressed.

HEAD PRESSURE CONTROL

Units with EXV — Microprocessor also controls EXV to maintain a superheat of 24° to 30° F (13.3° to 16.7° C) entering compressor cylinders.

Table 12 — Capacity Control Steps

30GT UNIT SIZE	CONTROL STEPS	LOADING SEQUENCE A		LOADING SEQUENCE B	
		% Displacement (Approx)	Compressors	% Displacement (Approx)	Compressors
040 (60 Hz) A1†	1	25	A1*	25	A1*
	2	50	A1	50	A1
	3	75	A1*, B1	75	A1*, B1
	4	100	A1, B1	100	A1, B1
040 (60 Hz) A1†, B1**	1	25	A1*	25	B1*
	2	50	A1*, B1*	50	A1*, B1*
	3	75	A1*, B1	75	A1, B1*
	4	100	A1, B1	100	A1, B1
040 (50 Hz) 045 (60 Hz) A1†	1	22	A1*	22	A1*
	2	44	A1	44	A1
	3	78	A1*, B1	78	A1*, B1
	4	100	A1, B1	100	A1, B1
040 (50 Hz) 045 (60 Hz) A1†, B1**	1	22	A1*	38	B1*
	2	59	A1*, B1*	59	A1*, B1*
	3	78	A1*, B1	81	A1, B1*
	4	100	A1, B1	100	A1, B1
045 (50 Hz) 050 (60 Hz) A1†	1	31	A1*	31	A1*
	2	46	A1	46	A1
	3	85	A1*, B1	85	A1*, B1
	4	100	A1, B1	100	A1, B1
045 (50 Hz) 050 (60 Hz) A1†, B1**	1	31	A1*	36	B1*
	2	67	A1*, B1*	66	A1*, B1*
	3	85	A1*, B1	85	A1, B1*
	4	100	A1, B1	100	A1, B1
050 (50 Hz) 060 (60 Hz) A1†	1	29	A1*	29	A1*
	2	43	A1	43	A1
	3	86	A1*, B1	86	A1*, B1
	4	100	A1, B1	100	A1, B1
050 (50 Hz) 060 (60 Hz) A1†, B1**	1	29	A1*	38	B1*
	2	67	A1*, B1*	67	A1*, B1*
	3	86	A1*, B1	81	A1, B1*
	4	100	A1, B1	100	A1, B1
060 (50 Hz) 070 (60 Hz) A1†	1	33	A1*	33	A1*
	2	50	A1	50	A1
	3	83	A1*, B1	83	A1*, B1
	4	100	A1, B1	100	A1, B1
060 (50 Hz) 070 (60 Hz) A1†, B1**	1	33	A1*	33	B1*
	2	67	A1*, B1*	67	A1*, B1*
	3	83	A1*, B1	83	A1, B1*
	4	100	A1, B1	100	A1, B1
070 (50 Hz) A1†	1	19	A1*	19	A1*
	2	29	A1	29	A1
	3	62	A1*, B1	62	A1*, B1
	4	72	A1, B1	72	A1, B1
	5	90	A1*, A2, B1	90	A1*, A2, B1
	6	100	A1, A2, B1	100	A1, A2, B1
070 (50 Hz) A1†, B1**	1	19	A1*	29	B1*
	2	48	A1*, B1*	48	A1*, B1*
	3	62	A1*, B1	57	A1, B1*
	4	72	A1, B1	72	A1, B1
	5	91	A1*, A2, B1	91	A1*, A2, B1
	6	100	A1, A2, B1	100	A1, A2, B1

*Compressor unloaded.
†Compressor unloader, standard.
**Compressor unloader, accessory.

NOTES:
1. The microprocessor has a random number generator that selects loading sequence A or B, which in turn determines the compressor circuit that is energized first. This balances operating hours on each circuit over an extended period of time.
2. If unit operation is anticipated with system load below minimum unloaded capacity of chiller:
   a. Consider using 2 smaller units in place of the larger unit.
   b. Increase *fluid loop volume* to ensure adequate run time (see Application Data in Product Data literature).
   c. Consider adding accessory hot gas bypass package.

Microprocessor control also cycles condenser fans on and off to maintain an adequate pressure differential across expansion valves. Fans are controlled by position of EXV and saturated condensing temperature thermistors (T3 and T4). When expansion valve is fully open and superheat is greater than 40° F (22° C), fan stages are removed; when the valve is approximately half open, fan stages are added. This allows unit to run at very low condensing temperatures at part load. Thus chiller has very high part-load EERs (energy efficiency ratios). Fan sequence is shown in Fig. 10.

Units with TXV — Thermostatic expansion valves, one for each refrigerant circuit, are factory set to maintain 8° to 10° F (5° to 6° C) superheat of vapor leaving cooler to control flow of liquid refrigerant into cooler. Superheat can be reset but should be done only if necessary.

Logic to cycle microprocessor-controlled fans is based on saturated condensing temperature only. This temperature is sensed by thermistors T3 and T4 (Fig. 11 and 12). The microprocessor will turn on an additional stage of fans when either of coil thermistors (T3 or T4) is greater than 113 F (45 C) and will turn off a fan stage when T3 and T4 are both below 73 F (23 C). Between each change in fan stage, control will wait one minute to allow head pressure to stabilize unless either T3 or T4 is greater than 125 F (52 C), in which case all microprocessor-controlled fans will come on immediately.

Condenser fan sequence is shown in Fig. 10.

REMOTE ON-OFF — When it is required to control the starting and stopping of the chiller from a remote location, such as a timeclock, the remote ON-OFF feature is used. See Fig. 7 for wiring information. If the chiller is being held ''OFF'' by the remote ON-OFF switch, appears in the display when the display button is pressed.

REMOTE ALARM — See Fig. 7 for remote alarm field wiring. Remove the resistor across terminals 1 and 2 on TB5 when remote alarm is being used.

SERVICE

ELECTRIC SHOCK HAZARD.
Turn off all power to unit before servicing. The ON-OFF switch on control panel does *not* shut off control power; *use field disconnect.*

Diagnostics and Troubleshooting — Refer to Controls and Troubleshooting book.

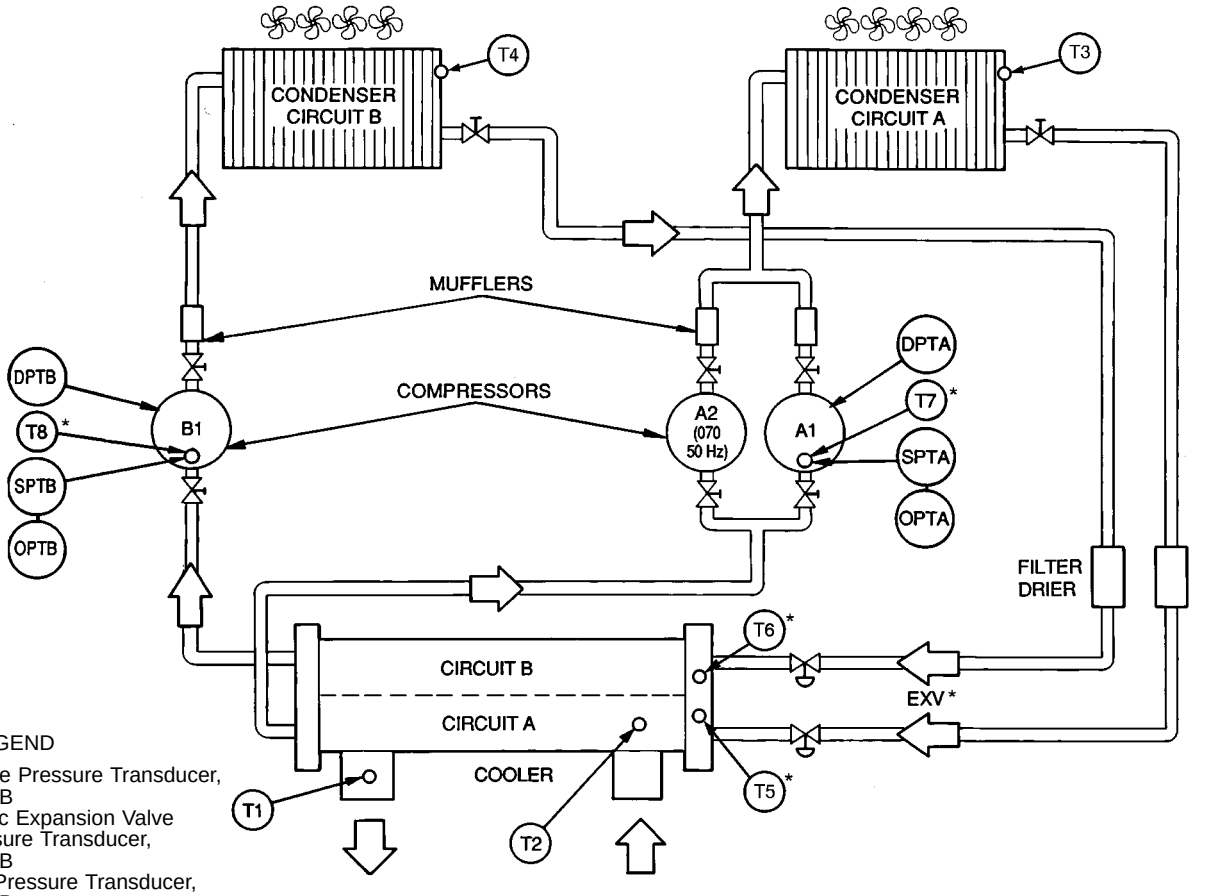
For field service use, a field-installed Ground Fault Interrupter (GFI) convenience outlet is available as an accessory for the 208/230-, 460-, and 575-v units. The GFI outlet is rated for 15 amps. However, in units with active cooler heaters, only 8 amps are available.

Refrigerant Circuit

LEAK TESTING — Units are shipped with complete operating charge of refrigerant R-22 (see Tables 1 and 2) and should be under sufficient pressure to conduct a leak test. If there is no pressure in the system, introduce enough nitrogen to search for the leak. Repair the leak using good refrigeration practices. After leaks are repaired, system must be evacuated and dehydrated.

REFRIGERANT CHARGE (Refer to Tables 1 and 2) — Immediately ahead of filter drier in each circuit is a factory-installed liquid line service valve. Each valve has a ¼-in. Schrader connection for charging liquid refrigerant.

Charging with Unit Off and Evacuated — Close liquid line service valve before charging. Weigh in charge shown on unit nameplate (also in Tables 1 and 2). Open liquid line service valve; start unit and allow it to run several minutes fully loaded. Check for a clear sight glass. Be sure clear condition is liquid and not vapor.



LEGEND

DPT — Discharge Pressure Transducer, Ckt A or B
EXV — Electronic Expansion Valve
OPT — Oil Pressure Transducer, Ckt A or B
SPT — Suction Pressure Transducer, Ckt A or B
T — Thermistor Number
TXV — Thermostatic Expansion Valve

*Not used with TXV.

Fig. 11 — Thermistor and Transducer Locations

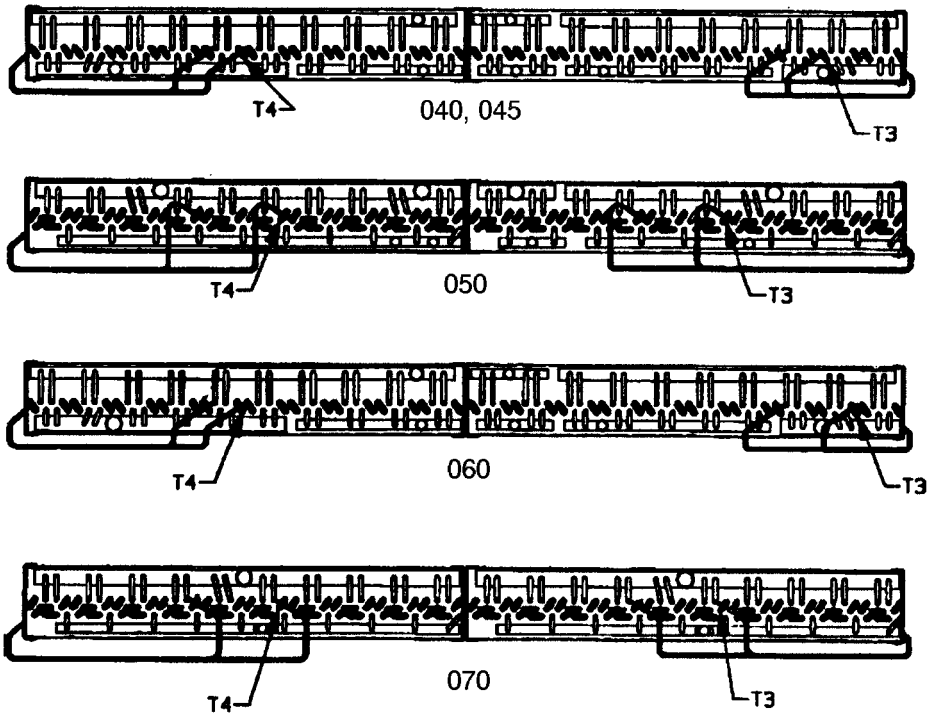


Fig. 12 — Thermistor T3 and T4 Locations

Charging with Unit Running — If charge is to be added while unit is operating, all condenser fans and compressors must be operating. It may be necessary to block condenser coils at low ambient temperatures to raise condensing pressure to approximately 280 psig (1931 kPa) to turn all condenser fans on. Do not totally block a coil to do this. Partially block all coils in uniform pattern. Charge each circuit until sight glass shows clear liquid, then weigh in amount over a clear sight glass as listed in Tables 1 and 2.

IMPORTANT: When adjusting refrigerant charge, circulate fluid through cooler continuously to prevent freezing and possible damage to the cooler. Do not overcharge, and never charge liquid into low-pressure side of system.

Electronic Components

CONTROL COMPONENTS — Unit uses an advanced electronic control system that normally does not require service. For details on controls, refer to Controls and Troubleshooting book.

UNIT CONTROL BOX — Viewed facing compressors, control box is at left end of unit. All incoming power enters through box. Control box contains power components and electronic controls. Outer panels are hinged and latched for easy opening. Remove screws to remove inner panels. Outer panels can be held open for service and inspection by using door retainer on each panel. Remove bottom pin from door retainer assembly, swing retainer out horizontally, and engage pin in one of the retainer ears and the hinge assembly.

Compressors — If lead compressor on either refrigerant circuit becomes inoperative for any reason, circuit is locked off and *cannot* be operated due to features built into the electronic control system. *Do not attempt to bypass controls to force compressors to run.*

COMPRESSOR REMOVAL — Access to the pump end of the compressor is from the compressor side of the unit. Access to the motor end of the compressor is from the inside of the unit. All compressors can be removed from the compressor side of the unit.

IMPORTANT: All compressor mounting hardware and support brackets removed during servicing must be reinstalled prior to start-up.

Following the installation of the new compressor:

Tighten discharge and suction service valves to —

	Compressor(s)
20 - 25 ft-lb (27 - 34 N-m)	06E250
80 - 90 ft-lb (109 - 122 N-m)	06E265,275,299

Tighten suction valves to —

80 - 90 ft-lb (109 - 122 N-m)	06E250
90 - 120 ft-lb (122 - 163 N-m)	06E265,275,299

Tighten the following fittings to —

120 in.-lb (13.5 N-m)	High-Pressure Switch
120 in.-lb (13.5 N-m)	Loss-of-Charge Switch

OIL CHARGE (Refer to Table 13) — All units are factory charged with oil. Acceptable oil level for each compressor is from ⅛ to ⅜ of sight glass (see Fig. 8).

When additional oil or a complete charge is required, use only Carrier-approved compressor oil.

Approved oils are as follows:

Petroleum Specialties, Inc. — Cryol 150 (factory oil charge)
Texaco, Inc. — Capella WF-32
Witco Chemical Co. — Suniso 3GS

Table 13 — Oil Charge

COMPRESSOR	OIL REQUIRED	
	Pts	L
06E250	14	6.6
06E265	19	9.0
06E275	19	9.0
06E299	19	9.0

Do not reuse drained oil, and do not use any oil that has been exposed to atmosphere.

Cooler — The cooler is easily accessible from the cooler side of the unit. The refrigerant feed components are accessible from the control box end of the unit.

COOLER REMOVAL — Cooler can be removed from the cooler side of the unit as follows:

1. To ensure the refrigerant is in the condenser, follow this procedure:
   a. For 30GT070 (50 Hz) only, open the circuit breaker and close the discharge valve for the lag compressor (A2).

⚠ WARNING

Do not close the discharge valve of an operating compressor. Severe damage to the compressor can result.

   b. Close the liquid line service valve for one circuit. Allow the lead compressor to pump down that circuit until it reaches approximately 10 to 15 psig (68.8 to 103.2 kPa).
   c. As soon as the system reaches that pressure, shut down the lead compressor by opening the compressor circuit breaker, then quickly close the discharge service valve for that compressor.
   d. Repeat the procedure for the other circuit.

⚠ CAUTION

Open and tag all electrical disconnects before any work begins. Keep in mind that cooler is heavy and both fluid-side and refrigerant-side may be under pressure.

2. Close the shutoff valves, if installed, in the cooler fluid lines, and remove the cooler fluid piping.
3. Open the air vent at the top of the cooler, and open the drain on the bottom of the cooler near the leaving fluid outlet to drain the cooler. Both the drain and the air vent are located on the leaving fluid end of cooler. See Fig. 13.
4. Disconnect the conduit and cooler heater wires, if equipped. Remove all thermistors from the cooler, being sure to label all thermistors as they are removed. Thermistor T2 is immersed directly in the fluid. Thermistors T1, T5, and T6 are friction-fit, well-type thermistors. See Fig. 13.
5. Remove the insulation on the refrigerant connection end of the cooler.
6. Unbolt the suction flanges from the cooler head. Save the bolts.
7. Remove the liquid lines by breaking the silver-soldered joints at the cooler liquid line nozzles.
8. Remove the screws in the cooler feet. Slide the cooler slightly to the left to clear the refrigerant tubing. Save all screws. Remove the cooler carefully.

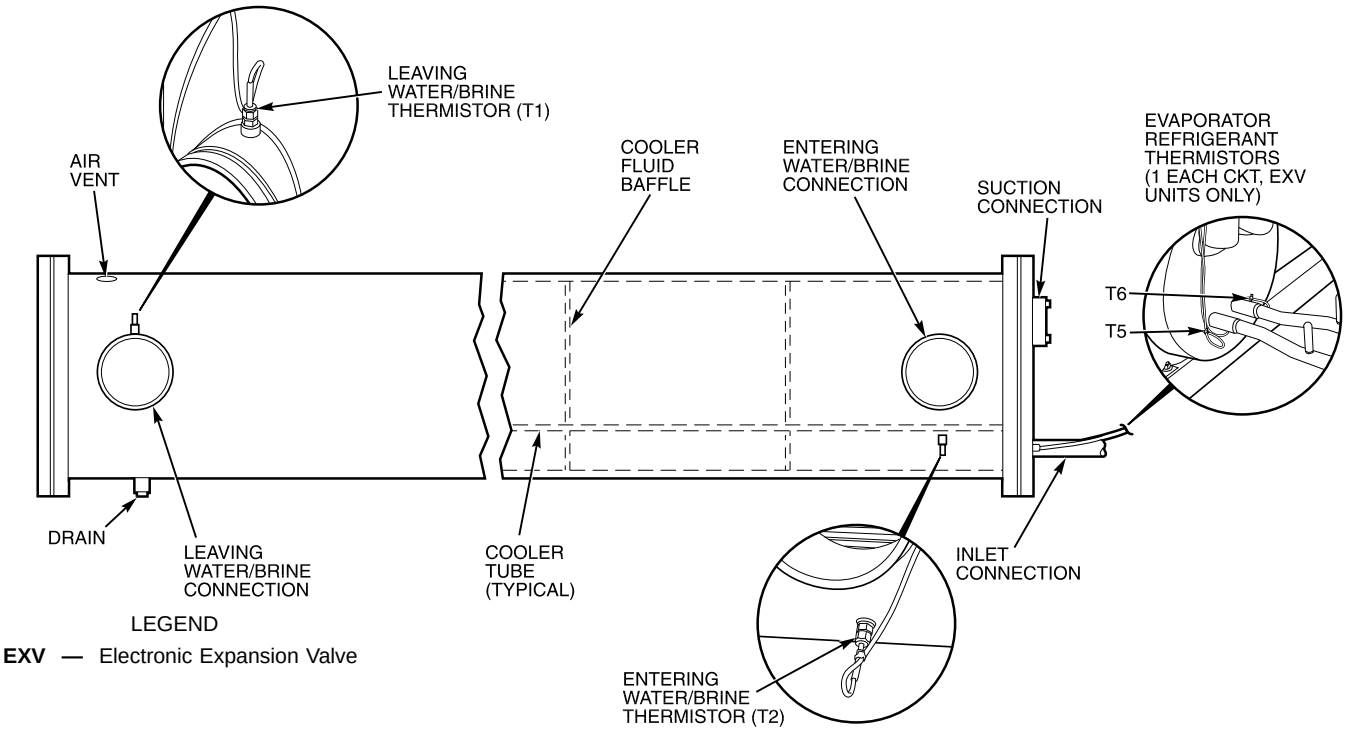


Fig. 13 — Cooler Thermistor Locations

REPLACING COOLER — To replace the cooler:

1. Insert new cooler carefully into place. Reattach the screws into the cooler feet (using saved screws).
2. Replace the liquid lines and solder at the cooler liquid line nozzles.
3. Rebolt the suction flanges onto the cooler head using bolts saved during removal. Use new gaskets for the suction line flanges. Use compressor oil to aid in gasket sealing, and tighten the suction flange bolts to 70 to 90 ft-lb (94 to 122 N-m).
   NOTE: The suction flange is a 4-bolt pattern. See Carrier specified parts for replacement part number, if necessary.
4. Use adhesive, and reinstall the cooler insulation on the refrigerant connection end of the cooler.
5. Reinstall the thermistors. Refer to Thermistors section on page 30, and install as follows:
   a. Apply pipe sealant to the ¼-in. NPT threads on the replacement coupling for the fluid side, and install it in place of the original.

⚠ CAUTION

Do not use the packing nut to tighten the coupling. Damage to the ferrules will result.

   b. Reinstall thermistor T1 well, and insert thermistor T1 into well.
   c. Install thermistor T2 (entering fluid temperature) so that it is not touching an internal refrigerant tube, but so that it is close enough to sense a freeze condition. The recommended distance is ⅛ in. (3.2 mm) from the cooler tube. Tighten the packing nut finger tight, and then tighten 1¼ turns more using a back-up wrench.
6. Install the cooler heater and conduit (if equipped), connecting the wires as shown in the unit wiring schematic located on the unit.
7. Close the air vent at the top of the cooler, and close the drain on the bottom of the cooler near the leaving fluid outlet. Both the drain and the air vent are located on the leaving fluid end of the cooler. See Fig. 13.
8. Reconnect the cooler fluid piping, and open the shutoff valves (if installed). Purge the fluid of all air before starting unit.
9. Open the discharge service valves, close the circuit breakers, and open the liquid line service valves for the compressors.

SERVICING COOLER — When cooler heads and partition plates are removed, tube sheets are exposed showing ends of tubes.

⚠ CAUTION

Certain tubes in the 10HB coolers cannot be removed. Eight tubes in the bundle are secured inside the cooler to the baffles and *cannot be removed.* These tubes are marked by a dimple on the tube sheet. See Fig. 14. *If any of these tubes have developed a leak, plug the tube(s) as described under Tube Plugging section below.*

Tube Plugging — A leaky tube can be plugged until retubing can be done. The number of tubes plugged determines how soon cooler *must* be retubed. Tubes plugged in the area of thermistor T2, particularly the tube that thermistor T2 is adjacent to, will affect unit reliability and performance. Thermistor T2 is used in the freeze protection algorithm for the controller. If several tubes require plugging, check with your local Carrier representative to find out how number and location can affect unit capacity.

Figure 15 shows an Elliott tube plug and a cross-sectional view of a plug in place.

⚠ CAUTION

Use extreme care when installing plugs to prevent damage to the tube sheet section between the holes.

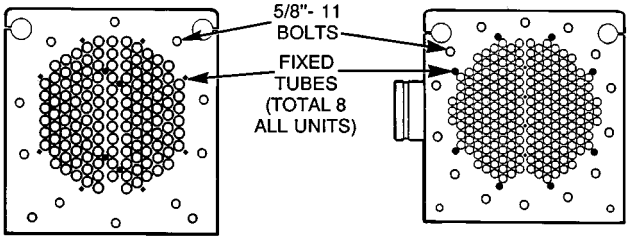


Fig. 14 — Typical Tube Sheets, Cover Off (Non-Removable Tubes)

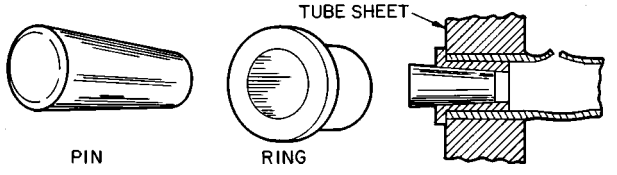


Fig. 15 — Elliott Tube Plug

Retubing (See Table 14) — When retubing is to be done, obtain service of qualified personnel experienced in boiler maintenance and repair. Most standard procedures can be followed when retubing the 10HB coolers. An 8% crush is recommended when rolling replacement tubes into the tube sheet. An 8% crush can be achieved by setting the torque on the gun at 48 to 50 in.-lb (5.4 to 5.6 N-m).

The following Elliott Co. tube rolling tools are required:

B3400 Expander Assembly
B3401 Cage
B3405 Mandrel
B3408 Rolls

Place one drop of Loctite No. 675 (or equivalent) on top of tube prior to rolling. This material is intended to ''wick'' into the area of the tube that is not rolled into the tube sheet, and prevent fluid from accumulating between the tube and the tube sheet.

Table 14 — Plugs

COMPONENTS FOR PLUGGING	PART NUMBER
For Tubes	
Brass Pin	853103-500*
Brass Ring	853002-570*
For Holes without Tubes	
Brass Pin	853103-1*
Brass Ring	853002-631*
Loctite	No. 675†
Locquic	''N''†

*Order directly from: Elliott Tube Company, Dayton, Ohio
†Can be obtained locally.

Tube information:

	in.	mm
• Tube sheet hole diameter	0.631	16.03
• Tube OD	0.625	15.87
• Tube ID after rolling (includes expansion due to clearance)	0.581 to 0.588	14.76 to 14.94

NOTE: Tubes next to gasket webs must be flush with tube sheet (both ends).

Tightening Cooler Head Bolts

Gasket Preparation — When reassembling cooler heads, always use new gaskets. Gaskets are neoprene-based and are brushed with a light film of compressor oil. *Do not soak gasket.* Use new gaskets within 30 minutes to prevent deterioration. Reassemble cooler nozzle end or plain end cover of the cooler with the gaskets. Torque all cooler bolts to the following specifications and sequence:

⅝-in. Diameter Perimeter Bolts . . . . . 150 to 170 ft-lb (201 to 228 N-m)
½-in. Diameter Flange Bolts . . . . . 70 to 90 ft-lb (94 to 121 N-m)

1. Install all bolts finger tight.
2. Bolt tightening sequence is outlined in Fig. 16. Follow the numbering sequence so that pressure is evenly applied to gasket.
3. Apply torque in one-third steps until required torque is reached. Load *all* bolts to each one-third step before proceeding to next one-third step.
4. No less than one hour later, retighten all bolts to required torque values.
5. After refrigerant is restored to system, check for refrigerant leaks with soap solution or Halide device.
6. Replace cooler insulation.

Condenser Coils

COIL CLEANING — Clean coils with a vacuum cleaner, fresh water, compressed air, or a bristle brush (not wire). Units installed in corrosive environments should have coil cleaning as part of a planned maintenance schedule. In this type of application, all accumulations of dirt should be cleaned off the coil.

⚠ CAUTION

Do not use high-pressure water or air — fin damage can result.

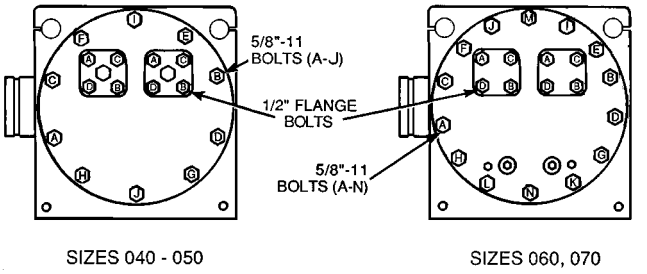


Fig. 16 — Cooler Head Bolt Tightening Sequence (Typical Tube Sheet)

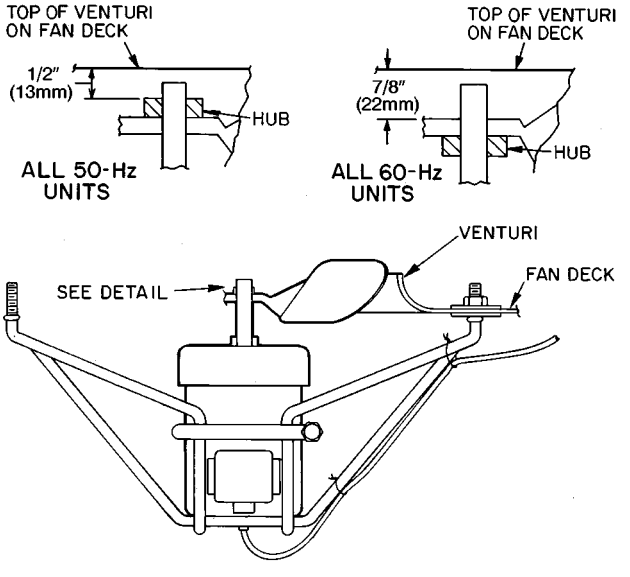
Condenser Fans — Each fan is supported by a formed wire mount bolted to fan deck and covered with a wire guard. The exposed end of fan motor shaft is protected from weather by grease. If fan motor must be removed for service or replacement, be sure to regrease fan shaft, and reinstall fan guard.

STANDARD CONDENSER FANS — For proper performance, top of fan propeller center should be ⅞ in. (22 mm) below top of venturi on the fan deck for 60 Hz units. For 50 Hz units, distance between top of venturi and top of fan hub should be ½ in. (13 mm). Tighten set screws to 15 ± 1 ft-lb (20 ± 1.3 N-m). Figure 17 shows proper position of mounted fan.

IMPORTANT: Check for proper fan rotation (clockwise viewed from above). If necessary to reverse fan rotation direction, switch any 2 power leads.

HIGH STATIC CONDENSER FANS — If the unit is equipped with the high static fan option, the fan must be set from the top of the fan deck to the plastic ring or center of the fan to a distance of 2.15 in. ± 0.12 in. (54.6 ± 3 mm). This is different from standard fans, since there is no area available to measure from the top of the orifice ring to the fan hub itself. See Fig. 18.

IMPORTANT: Check for proper fan rotation (clockwise viewed from above). If necessary to reverse fan rotation direction, switch any 2 power leads.



NOTE: Fan rotation is clockwise as viewed from top of unit.

Fig. 17 — Condenser Fan Adjustment for Units with Standard Condenser Fans

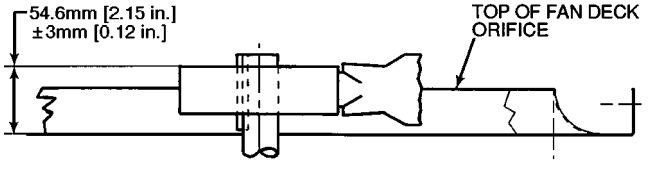


Fig. 18 — Condenser Fan Adjustment for Units with High Static Fan Option

Refrigerant Feed Components — Each circuit has all necessary refrigerant controls.

ELECTRONIC EXPANSION VALVE (EXV) — A cutaway drawing of valve is shown in Fig. 19.

High-pressure liquid refrigerant enters valve through bottom. A series of calibrated slots have been machined in side of orifice assembly. As refrigerant passes through orifice, pressure drops and refrigerant changes to a 2-phase condition (liquid and vapor). To control refrigerant flow for different operating conditions, sleeve moves up and down over orifice and modulates orifice size. Sleeve is moved by a linear stepper motor. Stepper motor moves in increments and is controlled directly by processor board. As stepper motor rotates, motion is transferred into linear movement by lead screw. Through stepper motor and lead screw, 1500 discrete steps of motion are obtained. The large number of steps and long stroke results in very accurate control of refrigerant flow. The valve orifice begins to be exposed at 320 steps. Since there is not a tight seal with the orifice and the sleeve, the minimum position for operation is 120 steps.

The microprocessor controls the valve. Two thermistor temperature sensors are used to determine superheat. One thermistor is located in the cooler and other is located in the passage between compressor motor and cylinders. The difference between the 2 temperatures controls superheat. On a normal TXV or EXV system, superheat leaving evaporator is 10° F (5.6° C). Motor then adds approximately 15° to 20° F (8° to 11° C), resulting in approximately 30° F (16.7° C) superheat entering cylinders.

Because EXVs are controlled by processor board, it is possible to track valve position. By this means, head pressure is controlled and unit is protected against loss of charge and a faulty valve. During initial start-up, EXV is fully closed. After initialization period, valve position is tracked by processor by constantly observing amount of valve movement.

The EXV is also used to limit cooler saturated suction temperature to 55 F (13 C). This makes it possible for chiller to start at higher cooler fluid temperatures without overloading compressor. This is commonly referred to as MOP (maximum operating pressure).

If it appears that EXV is not properly controlling operating suction pressure or superheat, there are a number of checks that can be made using quick test and initialization features built into the microprocessor control. See the following sections and Controls and Troubleshooting literature for more details.

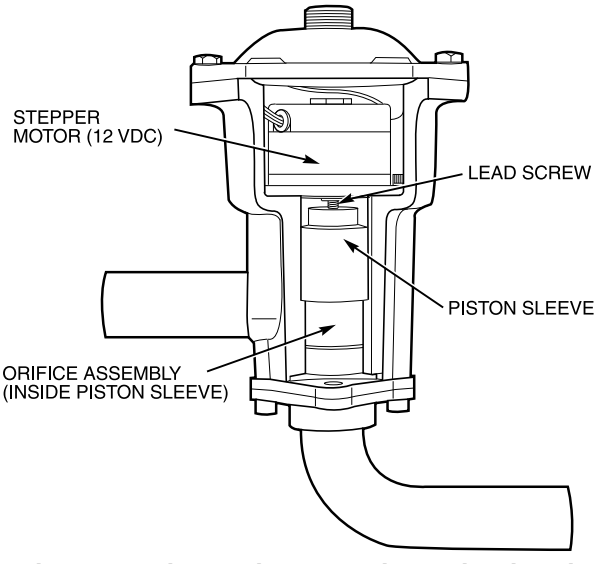


Fig. 19 — Electronic Expansion Valve (EXV)

Follow steps below to diagnose and correct EXV problems.

Step 1 — Check Processor EXV Outputs — Check EXV output signals at appropriate terminals on J7 terminal strip as follows:

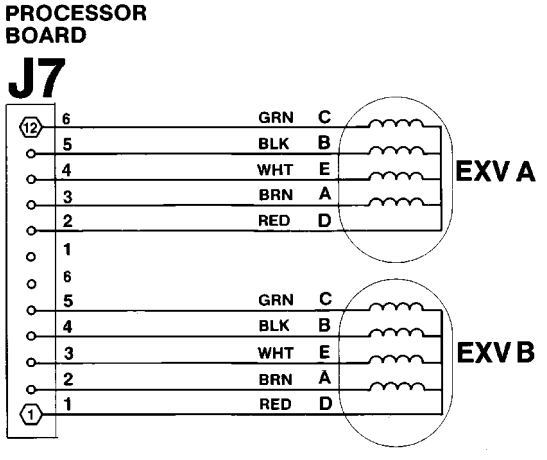
1. Turn power off.
2. Connect positive test lead of meter to terminal 8 on connector J7 (see Fig. 20).
3. Set meter for approximately 20 vdc.
4. Turn power on, but do not enter quick test mode. For the first 50 seconds, valve motor windings are alternately energized to close valve in circuit 1.
5. During this time, connect negative test lead to terminals 9, 10, 11, and 12 in succession. Voltage should rise and fall at each pin. If it remains constant at a voltage or at 0 v, remove connector and recheck. If problem still exists, replace processor board. If problem no longer exists, check EXV.
6. Turn power off and connect positive lead to terminal 1 on connector J7.
7. Turn power on. After 50 seconds, motor windings in circuit 2 valve will begin to be energized.
8. During this time, connect negative test lead to terminals 2, 3, 4, and 5. Voltage should rise and fall at each pin. If it remains constant at a voltage or at 0 v, remove connector and recheck. If problem still exists, replace processor board. If there is no longer a problem, check EXV.

Step 2 — Check EXV Wiring — Check wiring to EXVs from J7 terminal strip on processor board (see Fig. 20).

1. Check color coding and wire connections. Make sure wires are connected to correct terminals at J7 and EXV plug connections.
2. Check for continuity and tight connection at all pin terminals.
3. Check plug connections at J7 and at EXVs. Be sure EXV connections are not crossed.

Step 3 — Check Resistance of EXV Motor Windings — Remove plug at J7 terminal strip and check resistance between common lead (red wire, terminal D) and remaining leads A, B, C, and E. Resistance should be 25 ohms ± 2 ohms.

Step 4 — Check Thermistors that Control EXV — Check thermistors that control processor output voltage pulses to EXVs. Circuit A thermistors are T5 and T7, and circuit B thermistors are T6 and T8. Refer to Fig. 11 for location.



EXV — Electronic Expansion Valve

Fig. 20 — Processor Board Connections

1. Use quick test steps 2.0. through 2.3. to determine if thermistors are shorted or open.
2. Check thermistor calibration at a known temperature by measuring actual resistance and comparing value measured with values listed in Tables 15 and 16.
3. Make sure that thermistor leads are connected to proper pin terminals at J1 terminal strip on processor board and that thermistor probes are located in proper position in refrigerant circuit (Fig. 11 and 13).

When above checks have been completed, actual operation of EXV can be checked by using procedures outlined in Step 5 — Check Operation of the EXV section below. During quick test steps 3.5. and 3.9., each EXV is opened approximately 500 steps by processor. This quick test feature, along with initialization mode 20 , can be used to verify proper valve operation.

Step 5 — Check Operation of the EXV — Use following procedure to check actual operation of EXVs.

1. Close liquid line service valve for circuit to be checked and run through appropriate quick test step 3.5. or 3.9. to pump down low side of system. Repeat quick test step 3 times to ensure all refrigerant has been pumped from low side and that EXV has been driven fully open (1500 steps open).

   NOTE: Do not use control ON-OFF switch to recycle control during this step, and be sure to allow compressors to run full 10 seconds at each step.
2. Turn OFF control circuit switch and compressor circuit breaker(s). Close compressor service valves and remove any remaining refrigerant from low side of system.
3. Remove screws holding top cover of EXV. Carefully remove top cover, using caution to avoid damage to the O-ring seal and motor leads. If EXV plug was disconnected during this process, reconnect it after the cover is removed.
4. Note position of lead screw (see Fig. 19). If valve has responded properly to processor signals in Step 5.1 above, valve should be fully open and lead screw should protrude approximately ¼ in. (6 mm) to ¾ in. (19 mm) above top of motor.
5. Recycle control by turning control circuit switch to ON position. This puts control in initialization mode 20 . During first 100 seconds of initialization mode, each valve is driven to fully closed position (zero steps open) by processor. With cover lifted off EXV valve body, observe operation of valve motor and lead screw. The motor should turn in the counterclockwise (CCW) direction and lead screw should move down into motor hub until valve is fully closed. Lead screw movement should be smooth and uniform from fully open to fully closed position.
6. When test has been completed, carefully reassemble EXV. Be careful not to damage motor or O-ring when reassembling valve. Open compressor service valves and close compressor circuit breakers. Open liquid line service valve. Turn control circuit switch to ON position, and allow unit to operate. Verify proper operation of unit.

This process of opening and closing EXV can be repeated by repeating quick test steps 3.5. or 3.9. and recycling control as described in proceeding steps. If valve does not operate as described when properly connected to processor and receiving correct signals, it should be replaced.

If operating problems persist after reassembly, they may be due to out-of-calibration thermistor(s), or intermittent connections between processor board terminals and EXV plug. Recheck all wiring connections and voltage signals.

Table 15 — Sensor Temperature (°F) vs Resistance/Voltage Drop

TEMPERATURE (F)	VOLTAGE DROP (V)	RESISTANCE (OHMS)
- 25	4.684	98,010
- 24	4.673	94,707
- 23	4.662	91,522
- 22	4.651	88,449
- 21	4.640	85,485
- 20	4.628	82,627
- 19	4.616	79,871
- 18	4.604	77,212
- 17	4.591	74,648
- 16	4.578	72,175
- 15	4.565	69,790
- 14	4.551	67,490
- 13	4.537	65,272
- 12	4.523	63,133
- 11	4.509	61,070
- 10	4.494	59,081
- 9	4.479	57,162
- 8	4.463	55,311
- 7	4.448	53,526
- 6	4.431	51,804
- 5	4.415	50,143
- 4	4.398	48,541
- 3	4.381	46,996
- 2	4.363	45,505
- 1	4.345	44,066
0	4.327	42,678
1	4.308	41,339
2	4.289	40,047
3	4.270	38,800
4	4.250	37,596
5	4.230	36,435
6	4.209	35,313
7	4.188	34,231
8	4.167	33,185
9	4.145	32,176
10	4.123	31,201
11	4.101	30,260
12	4.078	29,351
13	4.055	28,472
14	4.032	27,624
15	4.008	26,804
16	3.984	26,011
17	3.959	25,245
18	3.934	24,505
19	3.909	23,789
20	3.883	23,096
21	3.858	22,427
22	3.831	21,779
23	3.805	21,153
24	3.778	20,547
25	3.751	19,960
26	3.723	19,392
27	3.696	18,843
28	3.668	18,311
29	3.639	17,796
30	3.611	17,297
31	3.582	16,814
32	3.553	16,346
33	3.523	15,892
34	3.494	15,453
35	3.464	15,027
36	3.434	14,614
37	3.404	14,214
38	3.373	13,826
39	3.343	13,449
40	3.312	13,084
41	3.281	12,730
42	3.250	12,387
43	3.219	12,053
44	3.187	11,730
45	3.156	11,416
46	3.124	11,111
47	3.093	10,816
48	3.061	10,529
49	3.029	10,250
50	2.997	9,979
51	2.965	9,717
52	2.933	9,461
53	2.901	9,213
54	2.869	8,973
55	2.837	8,739
56	2.805	8,511
57	2.772	8,291
58	2.740	8,076
59	2.708	7,868
60	2.676	7,665
61	2.644	7,468
62	2.612	7,277
63	2.581	7,091
64	2.549	6,911
65	2.517	6,735
66	2.486	6,564
67	2.454	6,399
68	2.423	6,237
69	2.391	6,081
70	2.360	5,929
71	2.329	5,781
72	2.299	5,637
73	2.268	5,497
74	2.237	5,361
75	2.207	5,229
76	2.177	5,101
77	2.147	4,976
78	2.117	4,855
79	2.088	4,737
80	2.058	4,622
81	2.029	4,511
82	2.000	4,403
83	1.972	4,298
84	1.943	4,195
85	1.915	4,096
86	1.887	4,000
87	1.859	3,906
88	1.832	3,814
89	1.805	3,726
90	1.778	3,640
91	1.751	3,556
92	1.725	3,474
93	1.699	3,395
94	1.673	3,318
95	1.647	3,243
96	1.622	3,170
97	1.597	3,099
98	1.572	3,031
99	1.548	2,964
100	1.523	2,898
101	1.500	2,835
102	1.476	2,773
103	1.453	2,713
104	1.430	2,655
105	1.407	2,598
106	1.385	2,542
107	1.362	2,488
108	1.341	2,436
109	1.319	2,385
110	1.298	2,335
111	1.277	2,286
112	1.256	2,238
113	1.236	2,192
114	1.216	2,147
115	1.196	2,103
116	1.176	2,060
117	1.157	2,018
118	1.138	1,977
119	1.120	1,937
120	1.101	1,898
121	1.083	1,860
122	1.065	1,822
123	1.048	1,786
124	1.030	1,750
125	1.013	1,715
126	0.997	1,680
127	0.980	1,647
128	0.964	1,614
129	0.948	1,582
130	0.932	1,550
131	0.917	1,519
132	0.902	1,489
133	0.887	1,459
134	0.872	1,430
135	0.857	1,401
136	0.843	1,373
137	0.829	1,345
138	0.815	1,318
139	0.802	1,291
140	0.788	1,265
141	0.775	1,239
142	0.762	1,214
143	0.750	1,189
144	0.737	1,165
145	0.725	1,141
146	0.713	1,118
147	0.701	1,095
148	0.689	1,072
149	0.678	1,050
151	0.655	1,007
152	0.644	986
153	0.634	965
154	0.623	945
155	0.613	925
156	0.602	906
157	0.592	887
158	0.582	868
159	0.573	850
160	0.563	832
161	0.554	815
162	0.545	798
163	0.536	782
164	0.527	765
165	0.518	749
166	0.509	734
167	0.501	719
168	0.493	705
169	0.484	690
170	0.476	677
171	0.468	663
172	0.461	650
173	0.453	638
174	0.446	626
175	0.438	614
176	0.431	602
177	0.424	591
178	0.417	581
179	0.410	570
180	0.403	560
181	0.397	551
182	0.390	542
183	0.384	533
184	0.378	524
185	0.371	516
186	0.365	508
187	0.360	501
188	0.354	494
189	0.348	487
190	0.342	480
191	0.337	473
192	0.332	467
193	0.326	461
194	0.321	456
195	0.316	450
196	0.311	444
197	0.306	439
198	0.301	434
199	0.297	429
200	0.292	424
201	0.288	419
202	0.283	415
203	0.279	410
204	0.274	405
205	0.270	401
206	0.266	396
207	0.262	391
208	0.258	386
209	0.254	382
210	0.250	377
211	0.247	372
212	0.243	366
213	0.239	361
214	0.236	356
215	0.232	350
216	0.229	344
217	0.225	338
218	0.222	332
219	0.219	325
220	0.215	318
221	0.212	311
222	0.209	304
223	0.206	297
224	0.203	289
225	0.200	282

Table 16 — Sensor Temperature (°C) vs Resistance/Voltage Drop

TEMPERATURE (C)	VOLTAGE DROP (V)	RESISTANCE (OHMS)
-32.0	4.690	100 049
-31.5	4.680	97 006
-31.0	4.671	94 061
-30.5	4.661	91 209
-30.0	4.651	88 449
-29.5	4.641	85 777
-29.0	4.630	83 191
-28.5	4.620	80 687
-28.0	4.609	78 264
-27.5	4.597	75 918
-27.0	4.586	73 648
-26.5	4.574	71 451
-26.0	4.562	69 324
-25.5	4.550	67 265
-25.0	4.537	65 272
-24.5	4.525	63 344
-24.0	4.512	61 477
-23.5	4.499	59 670
-23.0	4.485	57 921
-22.5	4.471	56 228
-22.0	4.457	54 589
-21.5	4.443	53 003
-21.0	4.428	51 467
-20.5	4.413	49 980
-20.0	4.398	48 541
-19.5	4.383	47 148
-19.0	4.367	45 799
-18.5	4.351	44 492
-18.0	4.334	43 228
-17.5	4.318	42 003
-17.0	4.301	40 817
-16.5	4.283	39 668
-16.0	4.266	38 556
-15.5	4.248	37 478
-15.0	4.230	36 435
-14.5	4.211	35 424
-14.0	4.193	34 444
-13.5	4.174	33 495
-13.0	4.154	32 576
-12.5	4.135	31 685
-12.0	4.115	30 821
-11.5	4.094	29 984
-11.0	4.074	29 173
-10.5	4.053	28 386
-10.0	4.032	27 624
- 9.5	4.010	26 884
- 9.0	3.989	26 168
- 8.5	3.967	25 472
- 8.0	3.944	24 798
- 7.5	3.922	24 144
- 7.0	3.899	23 509
- 6.5	3.876	22 893
- 6.0	3.852	22 296
- 5.5	3.829	21 716
- 5.0	3.805	21 153
- 4.5	3.781	20 606
- 4.0	3.756	20 076
- 3.5	3.732	19 561
- 3.0	3.707	19 061
- 2.5	3.682	18 575
- 2.0	3.656	18 103
- 1.5	3.631	17 645
- 1.0	3.605	17 199
- 0.5	3.579	16 766
0.0	3.553	16 346
0.5	3.526	15 937
1.0	3.500	15 539
1.5	3.473	15 153
2.0	3.446	14 777
2.5	3.419	14 412
3.0	3.392	14 057
3.5	3.364	13 711
4.0	3.337	13 375
4.5	3.309	13 048
5.0	3.281	12 730
5.5	3.253	12 420
6.0	3.225	12 119
6.5	3.197	11 826
7.0	3.169	11 541
7.5	3.140	11 263
8.0	3.112	10 992
8.5	3.083	10 729
9.0	3.054	10 472
9.5	3.026	10 223
10.0	2.997	9 979
10.5	2.968	9 742
11.0	2.939	9 512
11.5	2.911	9 287
12.0	2.882	9 068
12.5	2.853	8 855
13.0	2.824	8 647
13.5	2.795	8 444
14.0	2.766	8 247
14.5	2.737	8 055
15.0	2.708	7 868
15.5	2.680	7 685
16.0	2.651	7507
16.5	2.622	7334
17.0	2.593	7165
17.5	2.565	7000
18.0	2.536	6840
18.5	2.508	6683
19.0	2.479	6531
19.5	2.451	6382
20.0	2.423	6237
20.5	2.395	6096
21.0	2.367	5959
21.5	2.339	5825
22.0	2.311	5694
22.5	2.283	5566
23.0	2.256	5442
23.5	2.228	5321
24.0	2.201	5203
24.5	2.174	5088
25.0	2.147	4976
25.5	2.120	4867
26.0	2.094	4760
26.5	2.067	4656
27.0	2.041	4555
27.5	2.015	4457
28.0	1.989	4360
28.5	1.963	4267
29.0	1.938	4175
29.5	1.912	4086
30.0	1.887	4000
30.5	1.862	3915
31.0	1.837	3832
31.5	1.813	3752
32.0	1.789	3674
32.5	1.764	3597
33.0	1.741	3523
33.5	1.717	3450
34.0	1.693	3379
34.5	1.670	3310
35.0	1.647	3243
35.5	1.624	3177
36.0	1.602	3113
36.5	1.579	3051
37.0	1.557	2990
37.5	1.536	2931
38.0	1.514	2873
38.5	1.492	2816
39.0	1.471	2761
39.5	1.450	2707
40.0	1.430	2655
40.5	1.409	2603
41.0	1.389	2553
41.5	1.369	2504
42.0	1.349	2457
42.5	1.330	2410
43.0	1.311	2364
43.5	1.292	2320
44.0	1.273	2276
44.5	1.254	2234
45.0	1.236	2192
45.5	1.218	2152
46.0	1.200	2112
46.5	1.182	2073
47.0	1.165	2035
47.5	1.148	1997
48.0	1.131	1961
48.5	1.114	1925
49.0	1.098	1890
49.5	1.081	1856
50.0	1.065	1822
50.5	1.049	1789
51.0	1.034	1757
51.5	1.019	1725
52.0	1.003	1694
52.5	0.988	1663
53.0	0.974	1634
53.5	0.959	1604
54.0	0.945	1575
54.5	0.931	1547
55.0	0.917	1519
55.5	0.903	1492
56.0	0.890	1465
56.5	0.876	1438
57.0	0.863	1412
57.5	0.850	1387
58.0	0.837	1362
58.5	0.825	1337
59.0	0.812	1313
59.5	0.800	1289
60.0	0.788	1265
60.5	0.776	1242
61.0	0.765	1219
61.5	0.753	1197
62.0	0.742	1175
62.5	0.731	1153
63.0	0.720	1132
63.5	0.709	1111
64.0	0.698	1090
64.5	0.688	1070
65.0	0.678	1050
65.5	0.667	1030
66.0	0.657	1011
66.5	0.648	992
67.0	0.638	973
67.5	0.628	955
68.0	0.619	937
68.5	0.609	919
69.0	0.600	902
69.5	0.591	885
70.0	0.582	868
70.5	0.574	852
71.0	0.565	836
71.5	0.557	820
72.0	0.548	805
72.5	0.540	790
73.0	0.532	775
73.5	0.524	761
74.0	0.516	746
74.5	0.508	733
75.0	0.501	719
75.5	0.493	706
76.0	0.486	693
76.5	0.479	681
77.0	0.472	669
77.5	0.465	657
78.0	0.458	645
78.5	0.451	634
79.0	0.444	623
79.5	0.437	613
80.0	0.431	602
80.5	0.425	592
81.0	0.418	583
81.5	0.412	573
82.0	0.406	564
82.5	0.400	556
83.0	0.394	547
83.5	0.388	539
84.0	0.383	531
84.5	0.377	524
85.0	0.371	516
85.5	0.366	509
86.0	0.361	502
86.5	0.355	496
87.0	0.350	489
87.5	0.345	483
88.0	0.340	477
88.5	0.335	472
89.0	0.331	466
89.5	0.326	461
90.0	0.321	456
90.5	0.317	451
91.0	0.312	446
91.5	0.308	441
92.0	0.303	436
92.5	0.299	432
93.0	0.295	427
93.5	0.291	423
94.0	0.287	419
94.5	0.283	415
95.0	0.279	410
95.5	0.275	406
96.0	0.271	402
96.5	0.267	398
97.0	0.264	393
97.5	0.260	389
98.0	0.257	385
98.5	0.253	380
99.0	0.250	376
99.5	0.246	371
100.0	0.243	367
100.5	0.240	362
101.0	0.236	357
101.5	0.233	352
102.0	0.230	346
102.5	0.227	341
103.0	0.224	335
103.5	0.221	330
104.0	0.218	324
104.5	0.215	318
105.0	0.212	312
105.5	0.209	305
106.0	0.206	299
106.5	0.204	292
107.0	0.201	285

Other possible causes of improper refrigerant flow control could be restrictions in liquid line, plugged filter drier(s), stuck liquid line solenoid valve(s), or restricted metering slots in the EXV. Formation of ice or frost on lower body of EXV is one symptom of restricted metering slots. Clean or replace valve if necessary.

NOTE: Frosting of valve is normal during quick test steps 3.5. and 3.9. and at initial start-up. Frost should dissipate after a 5- to 10-minute operation of a system that is operating properly. If valve is to be replaced, wrap valve with a wet cloth to prevent excessive heat from damaging internal components. Superheat control built into valve is *not* adjustable.

NOTE: The EXV orifice is a screw-in type and may be removed for inspection and cleaning. Once the top cover has been removed, the EXV motor may be taken out by removing the 2 cap screws securing motor to valve body. Pull motor, lead screw, and the slide assembly up off the orifice assembly. A slot has been cut in top of orifice assembly to facilitate removal using a large screwdriver. Turn orifice assembly counterclockwise to remove.

When cleaning or reinstalling orifice assembly, be careful not to damage orifice assembly seals. The bottom seal acts as a liquid shut-off, replacing a liquid line solenoid valve.

Reassembly of valve is made easier by screwing the slide and lead screw assembly out of the motor. Align hole in top of slide with the guide pin in orifice assembly, and gently push slide and lead screw onto orifice assembly about half way. Screw motor onto lead screw and secure EXV motor with cap screws. Be careful not to twist or pull on wires from EXV motor to valve cover pin connections. Check EXV operation in test steps outlined on page 27.

THERMOSTATIC EXPANSION VALVE (TXV) — The FIOP chiller is equipped with conventional TXV, one per circuit. This control system necessitates use of a liquid line solenoid valve. TXV is factory set to maintain 8° to 10° F (4.4° to 5.6° C) superheat of vapor leaving cooler by controlling flow of refrigerant into cooler. *Superheat can be reset but should be done only if absolutely necessary.*

When TXV is used, thermistors T5, T6, T7, and T8 are eliminated (see Fig. 11).

TXV also incorporates an MOP feature to limit cooler suction to 55 F (13 C), making it possible for compressor to start at higher cooler-fluid temperatures without overloading.

MOISTURE-LIQUID INDICATOR — Clear flow of liquid refrigerant indicates sufficient charge in system. Bubbles in the sight glass indicate undercharged system or presence of noncondensables. Moisture in system measured in parts per million (ppm), changes color of indicator:

Green — moisture is below 45 ppm
Yellow-green (chartreuse) — 45 to 130 ppm (caution)
Yellow (wet) — above 130 ppm

Change filter drier at first sign of moisture in system.

IMPORTANT: Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading. With unit running, indicating element must be in contact with liquid refrigerant to give true reading.

FILTER DRIER — Whenever moisture-liquid indicator shows presence of moisture, replace filter driers. There is one filter drier on each circuit.

LIQUID LINE SOLENOID VALVE — All units have a liquid line solenoid valve to prevent liquid refrigerant migration to low side of system during the off cycle.

LIQUID LINE SERVICE VALVE — This valve is located immediately ahead of filter drier, and has a ¼-in. Schrader connection for field charging. In combination with compressor discharge service valve, each circuit can be pumped down into the high side for servicing.

Thermistors — Electronic control uses 4 to 9 thermistors to sense temperatures used to control the operation of chiller. See Table 17 for thermistors used.

Table 17 — Temperature Sensors (Thermistors)

SENSOR	TEMPERATURE
T1	Cooler Leaving Fluid
T2	Cooler Entering Fluid
T3	Saturated Condensing Temperature — Circuit A
T4	Saturated Condensing Temperature — Circuit B
T5*	Evaporator Refrigerant Temperature — Circuit A
T6*	Evaporator Refrigerant Temperature — Circuit B
T7*	Compressor Return Gas Temperature — Circuit A
T8*	Compressor Return Gas Temperature — Circuit B
T10	Remote Temperature Sensor (Accessory)

*Not used on units with thermostatic expansion valve.

All thermistors are identical in their temperature vs resistance and voltage drop performance. Resistances at various temperatures are listed in Table 15 or 16.

LOCATION — General locations of thermistor sensors are shown in Fig. 11.

Cooler Leaving Fluid Sensor (T1) — Sensor T1 is located in the leaving-fluid nozzle. The probe is in a well immersed in the fluid. Actual location is shown in Fig. 11 and 13.

Cooler Entering Fluid Sensor (T2) — Sensor T2 is located in the cooler shell in first baffle space, in close proximity to tube bundle. The ¼-in. coupling is used (Fig. 21). Actual location is shown in Fig. 11 and 13.

Saturated Condensing Temperature Sensors (T3 and T4) — Sensors T3 and T4 are each clamped to outside of a return bend on condenser coil. Exact locations for all units are shown in Fig. 11 and 12.

Evaporator Refrigerant Sensors (T5 and T6) — Sensors T5 and T6 are located next to refrigerant inlet in cooler head. Thermistors are well-type thermistors. Typical location is shown in Fig. 11 and 13. (Not used on units with TXV.)

Compressor Return Gas Temperature Sensors (T7 and T8) — Sensors T7 and T8 are located in lead compressor in each circuit in a suction passage between motor and cylinders above oil pump. They are well-type thermistors. Location is shown in Fig. 11. (Not used on units with TXV.)

Remote Sensor (T10) — Sensor T10 is an accessory sensor and is mounted remotely from unit. It is used for outdoor-air or space temperature reset.

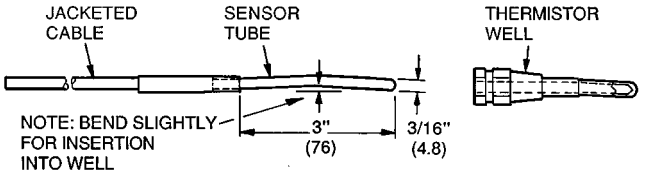
⚠ CAUTION

Sensor T2 is installed directly in the fluid circuit. Relieve all pressure or drain fluid before removing.

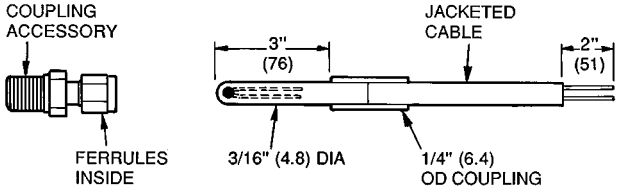
To troubleshoot a sensor, refer to separate Controls and Troubleshooting literature.

REPLACING THERMISTOR T2

1. Remove and discard original sensor and coupling. Do not disassemble new coupling. Install assembly as received.
2. Apply pipe sealant to ¼-in. NPT threads on replacement coupling, and install in place of original. Do not use the packing nut to tighten coupling. Damage to ferrules will result.



FLUID-SIDE TEMPERATURE SENSOR (T1) AND REFRIGERANT TEMPERATURE SENSOR (T5, T6, T7, T8)



FLUID-SIDE TEMPERATURE SENSOR (T2)

NOTE: Dimensions in ( ) are in millimeters.

Fig. 21 — Thermistors (Temperature Sensors)

3. Thermistor T2 (entering fluid temperature) should not be touching an internal refrigerant tube, but should be close enough to sense a freeze condition. Recommended distance is ⅛ in. (3.2 mm) from cooler tube. Tighten packing nut finger tight to position ferrules, then tighten 1¼ turns more using a back-up wrench. Ferrules are now attached to the sensor, which can be withdrawn from coupling for service.

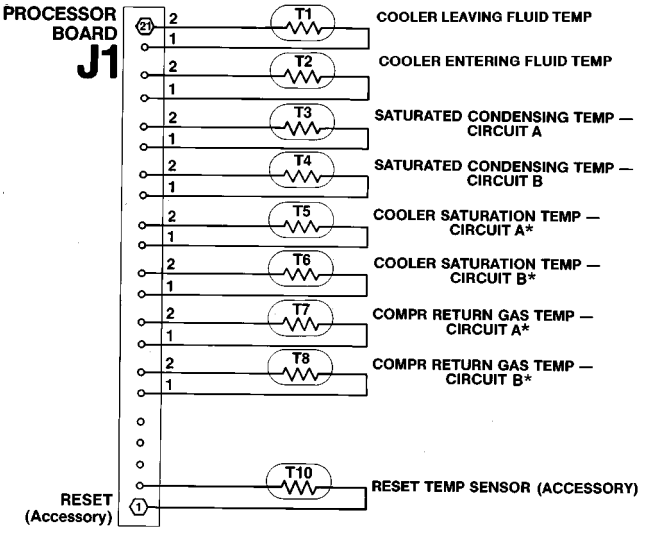
REPLACING THERMISTORS T1, T5, T6, T7, AND T8 — Add a small amount of thermal conductive grease to thermistor well. Thermistors are friction-fit thermistors, which must be slipped into receivers located in the cooler leaving fluid nozzle for T1, in the cooler head for T5 and T6 (EXV units only), and in the compressor pump end for T7 and T8 (EXV units only).

THERMISTORS T3 AND T4 — These thermistors are located on header end of condenser coil. They are clamped on a return bend.

THERMISTOR/TEMPERATURE SENSOR CHECK — A high quality digital volt-ohmmeter is required to perform this check.

1. Connect the digital voltmeter across the appropriate thermistor terminals at the J1 terminal strip on the processor board (see Fig. 22 and Fig. 9). Using the voltage reading obtained, read the sensor temperature from Table 15 or 16. To check thermistor accuracy, measure temperature at probe location with an accurate thermocouple-type temperature measuring instrument. Insulate thermocouple to avoid ambient temperatures from influencing reading. Temperature measured by thermocouple and temperature determined from thermistor voltage reading should be close, ± 5° F (3° C) if care was taken in applying thermocouple and taking readings.
2. If a more accurate check is required, unit must be shut down and thermistor removed and checked at a known temperature (freezing point or boiling point of water) using either voltage drop measured across thermistor at the J1 terminals with unit in quick test mode 88 or by determining the resistance with chiller shut down and thermistor disconnected from J1.

Safety Devices — Chillers contain many safety devices and protection logic built into electronic control. Following is a brief summary of major safeties. For complete details refer to Controls and Troubleshooting literature.



T1-T8, T10 THERMISTORS

COMPR — Compressor

*Not used on FIOP (Factory-Installed Option) unit with TXV (Thermostatic Expansion Valve).

Fig. 22 — Thermistor Connections to J1 Processor Board

COMPRESSOR PROTECTION

Circuit Breaker — One manual-reset, calibrated-trip, magnetic circuit breaker for each compressor protects against overcurrent. Do not bypass or increase size of a breaker to correct problems. Determine cause for trouble and correct before resetting breaker. Circuit breaker must-trip amps (MTA) are listed on individual circuit breakers and on unit label diagrams.

Compressor Protection Board (CPCS) or Control Relay (CR) — The CPCS or CR is used to control and protect compressors and crankcase heaters. Each provides following features:

- Compressor contactor control
- Crankcase heater control
- Ground current protection (CPCS only)
- Status communication to processor board
- High-pressure protection

One large relay located on CPCS board (or unit CR) controls crankcase heater and compressor contactor. In addition, relay provides a set of contacts that microprocessor monitors to determine operating status of compressor. If processor board determines that compressor is not operating properly through signal contacts, control locks compressor off.

The CPCS contains logic that can detect if current-to-ground of any winding exceeds 2.5 amps; if so, compressor shuts down.

A high-pressure switch with a trip pressure of 426 ± 7 psig (2936 ± 48 kPa) is mounted on each compressor; switch setting is shown in Table 18. Switch is wired in series with the CPCS or control relay. If switch opens, CPCS relay or CR opens, processor detects it through signal contacts, and compressor locks off.

Table 18 — Pressure Switch Settings, psig (kPa)

SWITCH	CUTOUT	CUT-IN
High Pressure	426 ± 7 (2936 ± 48)	320 ± 20 (2205 ± 138)
Loss-of-Charge	7 (48.2)	22 (151.6)

If any of these switches opens during operation, the compressor stops and the failure is detected by processor when signal contacts open. On size 070, 50 Hz only, if lead compressor in either circuit is shut down by high-pressure switch, ground current protection, loss-of-charge switch, or oil pressure switch, both compressors in the circuit (if applicable) are locked off.

LOW OIL PRESSURE PROTECTION — Lead compressor in each circuit is equipped with a switch to detect low oil pressure. Switch is connected directly to processor board. Switch is set to open at approximately 5 psig (35 kPa) and to close at 9 psig (62 kPa) maximum. If switch opens when compressor is running, CR or processor board stops all compressors in circuit. During start-up, switch is bypassed for 2 minutes.

CRANKCASE HEATERS — Each compressor has a 180-w crankcase heater to prevent absorption of liquid refrigerant by oil in crankcase when compressor is not running. Heater power source is auxiliary control power, independent of main unit power. This assures compressor protection even when main unit power disconnect switch is off.

IMPORTANT: Never open any switch or disconnect that deenergizes crankcase heaters unless unit is being serviced or is to be shut down for a prolonged period. After a prolonged shutdown or service, energize crankcase heaters for 24 hours before starting unit.

COOLER PROTECTION

Freeze Protection — Cooler can be wrapped with heater cables (optional) as shown in Fig. 23, which are wired through an ambient temperature switch set at 36 F (2 C). Entire cooler is covered with closed-cell insulation applied over heater cables. Heaters plus insulation protect cooler against low ambient temperature freeze-up to 0° F (−18 C).

IMPORTANT: If unit is installed in an area where ambient temperatures fall below 32 F (0° C), it is recommended that inhibited ethylene glycol or other suitable corrosion-inhibitive antifreeze solution be used in chilled-fluid circuit.

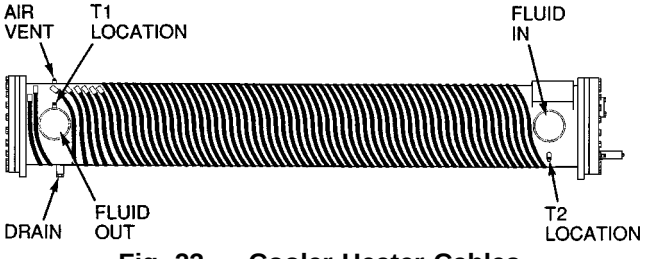


Fig. 23 — Cooler Heater Cables

Low Fluid Temperature — Microprocessor is programmed at the factory to shut chiller down if leaving-fluid temperature drops below 35 F (1.7 C). When fluid temperature rises 6° F (3.3° C) above leaving-fluid set point, safety resets and chiller restarts.

Loss of Fluid Flow Protection — Microprocessor contains internal logic that protects cooler against loss of cooler flow. Entering- and leaving-fluid temperature sensors in cooler detect a no-flow condition. Leaving sensor is located in leaving fluid nozzle and entering sensor is located in first cooler baffle space in close proximity to cooler tubes, as shown in Fig. 13. When there is no cooler flow and the compressors start, leaving-fluid temperature does not change. However, entering-fluid temperature drops rapidly as refrigerant enters cooler. Entering sensor detects this temperature drop and when entering temperature is 5° F (2.8° C) below leaving temperature, unit stops and is locked off.

Loss-of-Charge — A pressure switch connected to high side of each refrigerant circuit protects against total loss-of-charge. Switch settings are listed in Table 18. If switch is open, unit cannot start; if it opens during operation, unit locks out and cannot restart until switch is closed. Low charge is also monitored by the processor when an EXV is used.

A low charge is detected by monitoring EXV position and superheat entering the compressor. If EXV is wide open, superheat is greater than 50° F (28° C), and saturated cooler suction is less than 55 F (13 C), circuit is stopped and locked off.

Relief Devices — Fusible plugs are located in each circuit to protect against damage from excessive pressures.

HIGH-SIDE PROTECTION — One device is located between condenser and filter drier; a second is on filter drier. These are both designed to relieve on a temperature rise to approximately 210 F (99 C).

LOW-SIDE PROTECTION — A device is located on suction line, designed to relieve on a temperature rise to approximately 170 F (77 C).

COMPRESSOR PROTECTION

Pressure Relief Valves — Valves for unit sizes 040-070, 60 Hz, and 040-060, 50 Hz, are installed in compressors A1 and B1. Valves for unit size 070, 50 Hz are installed in compressors A2 and B1. These valves are designed to relieve at 450 psig (3103 kPa). *These valves should not be capped.* If a valve relieves, it should be replaced. If valve is not replaced, it may relieve at a lower pressure, or leak due to trapped dirt from the system, which may prevent resealing.

The pressure relief valves are equipped with a ⅜-in. SAE (Society of Automotive Engineers, U.S.A.) flare for field connection. Some local building codes require that relieved gases be removed. This connection will allow conformance to this requirement.

Other Safeties — There are several other safeties that are provided by microprocessor control. For details refer to Controls and Troubleshooting literature.

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